USER REQUEST EVALUATION TOOL
CORE CAPABILITY LIMITED DEPLOYMENT
(URET CCLD)

SYSTEM SPECIFICATION DOCUMENT

FAA-ER-2929

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1. SCOPE

1.1 Identification

This specification establishes the functional and performance requirements for User Request Evaluation Tool Core Capability Limited Deployment (URET CCLD). This tool is being developed as part of the Free Flight Phase 1 (FFP1) program. URET CCLD is specified here to be composed of the Enhanced Display System Infrastructure (EDI), which includes the URET CCLD application called Conflict Probe (CP). This specification encompasses the requirements for controller and supervisor interaction with the Air Traffic Control (ATC) operational position, EDI services, system monitoring and control capabilities, system performance characteristics and capabilities, external interfaces, and system support.

This document includes the legacy DSR requirements stated in DSR SSD, FAA-ER-130-006, in addition to follow-on CR numbers 6224 and 6227 dated September 21, 1998. These legacy requirements are included for completeness. DD numbers have been added to requirements to aid in associating them with A-level Contractor requirements. Where DD numbers have not been currently assigned, DD** is used.

1.2 Background

This specification represents the first iteration of a requirements document which will ultimately define the En Route Domain Infrastructure and the ATC applications which will utilize EDI resources. The objective of evolving the DSR infrastructure to an En Route Infrastructure is to provide a set of resources at the Air Route Traffic Control Centers (ARTCCs) which will accommodate regular and planned additions to ATC functionality and will support the evolution of En Route domain applications. Standardized interfaces will be defined to facilitate this evolution.

The CP application will be the first ATC application to utilize the EDI resources. CP will evolve from the URET evaluation and Daily Use capabilities at the Indianapolis and Memphis ARTCCs. The development, validation and deployment of URET CCLD will be incremental and evolutionary.

2. APPLICABLE DOCUMENTS

The following documents include standards, guidelines, handbooks, and special publications. These documents are applicable to the extent specified within this specification. The documents have been grouped into two categories: Reference Documents and Compliance Documents.

2.1 Reference Documents

The documents in the following subsections are for reference information only.

2.1.1 Specifications

NAS-MD-741	Interface Control Document, Direct Access Radar Channel (DARC), Host Computer System/DARC Control Processor

NAS-MD-742	Interface Control Document, Direct Access Radar Channel (DARC), Data Receiver Group (DRG)/DARC Radar Multiplexer
NAS-IC-21014201	VSCS Console Equipment to Common Console, Part II
NAS-IC-43020001	National Airspace Data Interchange Network (NADIN) Packet Switched Network (PSN) X.25 Packet Mode Users, 4 April 1996
NAS-MD-745	Computer Program Functional Specification, Direct Access Radar Channel (DARC), Weather Message Switching Unit
NAS-SS-1000	NAS System Specification, Functional and Performance Requirements for the National Airspace System, General

2.1.2 Standards

2.1.2.1 EDI Standards

2.1.2.1.1 Platform Operating System Standards

ISO/IEC 9945-1:1996	Standard for Information Technology – Portable Operating Systems Interface (POSIX) – Part 1: System Application Program Interface (API) [C language binding]
ISO/IEC 9945-1:1996, (Table 2-10 of Section 2.9.3)	Real-time Extensions: Compile Time Symbolic Constants
ISO/IEC 9945-2:1993	Standard for Information Technology – Portable Operating Systems Interface (POSIX) – Part 2: Shell and Utilities
IEEE 1003.5	IEEE Standard for Information Technology – Portable Operating Systems Interface (POSIX) – System API [Ada language binding]
	Standard for Information Technology – Portable Operating Systems Interface (POSIX) – System API [C++ language binding]

2.1.2.1.2 Distributed Computing Standards

CORBA/IIOP 2.1, formal/97-09-01	Common Object Request Broker Architecture/Internet Inter-ORB Protocol (CORBA/IIOP) Version 2.1. (Object Management Group)
CORBA services, formal/97-07-04	CORBA Services Specification. (Object Management Group)

2.1.2.1.3 Computer-Human Interface Generation Standards

2.1.2.1.3.1 Windowing Display Standards

2.1.2.1.3.1.1 Intrafacility Windowing Display Standards

X-Windows X11 R5 or newer	X-Windows X11 Release 5 compatible with selected Motif version. (The Open Group).
Motif 1.2 or newer	Motif Style Guide compatible with selected X-Windows release. (The Open Group).

2.1.2.1.3.2 Direct Graphics Display Standards

Open GL version 1.2 or newer	OpenGL (Open Graphics Language). (Object Management Group)

2.1.2.1.4 System and Network Management Standards

IETF STD 15	A Simple Network Management Protocol (SNMP) (includes IETF RFC 1157)
IETF STD 16	Structure and Identification of Management Information for TCP/IP-based Internets; Concise Management Information Base (MIB) Definitions (includes IETF RFCs 1155 and 1213)
IETF STD 17	MIB for Network Management of TCP/IP-based Internets (MIB-II) (includes IETF RFC 1213)
IETF RFC 1271	Remote Network Monitoring MIB
IETF RFC 1441	Introduction to Version 2 of SNMP (SNMPv2)
IETF RFC 1757	Remote Network Monitoring MIB
IETF RFC 1902	Structure of Management Information (SMI) for SNMPv2
IETF RFC 1903	Textual Conventions for SNMPv2
IETF RFC 1904	Conformance Statements for SNMPv2
IETF RFC 1905	Protocol Operations for SNMPv2
IETF RFC 1906	Transport Mappings for SNMPv2
IETF RFC 1908	Coexistence between SNMPv1 and SNMPv2

2.1.2.1.5 Communications Standards

FAA-STD-039 Revision B	NAS Open System Architecture and Protocols
IETF STD 3	Requirements for Internet Hosts (includes IETF RFCs 1122 and 1123)
IETF STD 5	Internet Protocol, Version 4 (IPv4) (includes IETF RFCs 19, 791, 792, 922, 950, and 1112.)
IETF STD 6	User Datagram Protocol (UDP)) (includes IETF RFC 768.)
IETF STD 7	Transmission Control Protocol (TCP) (includes IETF RFC 793.)
IETF STD 20	Echo Protocol
IETF STD 43	Internet Protocol on IEEE 802 (ISO 8802-2)
ISO 8802-2:1994	Information Processing Systems -- Local Area Networks – Part 2: Logical Link Control

2.1.2.1.5.1 Wide Area Network Access Standards

ITU-T X.25	International Telecommunications Union-Telecommunications (ITU-T) Recommendation X.25, 1984

2.1.2.1.6 ARTCC Data Management Standards

For intraprocessor, interprocessor, and interfacility access:

ANSI X3.135-1992	Data Base Access: Structured Query Language ("SQL-92")
FIPS 193	Structured Query Language (SQL) Environments
ODBC	Open Data base Connectivity Remote Data Access

2.1.2.1.7 Programming Language Standards

ANSI/ISO 9899-1992	C Language
ISO/IEC DIS 14882	C++ Language
ISO/IEC 8652, 1995	Ada Language
FIPS 193	Structured Query Language (SQL) Environments

2.1.2.1.8 Mission Support Standards

(No number)	"The North Atlantic Common Coordination Interface Control Document", Version 1.2, October 1994, published by the North Atlantic System Planning Group within ICAO
ICAO Document 4444	Procedures for Air Navigation Services – Rules of the Air and Air Traffic Services (PANS-RAC), July 11, 1996

2.1.3 Other Documents

AT&T Bulletin	New Equipment – Building System (NEBS) 326-130, General Equipment Requirements Pub 51001
ANSI/IEEE Standard	IEEE Recommended Practices for Seismic Standard 344 Qualification of class IE Equipment for Nuclear Power Generating Stations
FAA-HDBK-002	Systems Management
FAA-HDBK-003	NAS Open System Environment (OSE) Application Services
FAA-HDBK-004	NAS Internet Protocol Suite
NAS-81-0056	Terminal System Support Facility Handbook
NAS-5204-02	National Airspace System En Route System Support Facility, Hardware Environment Handbook, Volume 1

2.2 Compliance Documents

The documents in the following subsections are applicable to the extent specified herein. In the event of a conflict between a listed document and other requirements of this specification, the requirements in this specification shall take precedence.

2.2.1 Specifications

NAS-MD-311	Computer Program Functional Specification, Message Entry and

	Checking (Model A4e1.2)
NAS-MD-312	Computer Program Functional Specification, route Conversion and Posting (Model A4e1.2)
NAS-MD-314	Computer Program Functional Specification, Local Outputs (Model A4e1.2)
NAS-MD-316	Computer Program Functional Specification, Adaptation
NAS-MD-317	Computer Program Functional Specification, Monitor (Model A4e0.3 En Route Stage A)
NAS-MD-320	Computer Program Functional Specification, Multiple Radar Data Processing
NAS-MD-323	Computer Program Functional Specification, Dynamic Simulation of Radar Data
NAS-MD-324	Computer Program Functional Specifications, Display Channel Interface Requirements (Model A4e0.1 En Route Stage A)
NAS-MD-581	Interface Control Document, Flight Data Input/ Output Program (FDIO), Software Interface Control Document (SICD)
NAS-MD-850	Central Flow Automation Facility - NAS Stage A En Route Central Computer Complex
NAS-MD-1311	Computer Program Functional Specification, Message Entry and Checking, Direct Access Radar Channel (DARC)
NAS-MD-1314	Computer Program Functional Specification, Local Outputs, Direct Access Radar Channel (DARC)
NAS-IC-25152104	WARP Interface Control Document

2.2.2 Standards

2.2.2.1 Engineering Standards

FAA-STD-001	Color and Texture of Finishes for National Airspace System Equipment
FAA-STD-019	Lightning Protection, Grounding, Bonding and Shielding Requirements for Facilities
FAA-STD-020	Transient Protection, Grounding, Bonding and Shielding in FAA Facilities
MIL-STD-454	Standard General Requirements for Electronic Equipment
MIL-STD-461	Electromagnetic Emission and Susceptibility Requirements for Control of Electromagnetic Interference
MIL-STD-721	Definition of Terms for Reliability and Maintenance
MIL-STD-781	Reliability Design Qualification and Production Acceptance Tests Exponential Distribution
MIL-STD-1472	Human Engineering Design Criteria for Military Systems Equipment and Facilities

2.2.3 Other Documents

ENET1370-001.1:1995	FAA Enterprise Network naming and Addressing Standard
FAA-C-1217E	Electrical Work, Interior
FAA-E-2603	Noise Canceling Headset and Handset
FAA-G-2100F	Electronic Equipment, General Requirements
FAA Order 1370.nn	FAA Enterprise Internet Protocol Suite (includes by reference a supplement, ENET 137—002.2A, for FAA Internet Protocol numbering range assignments
FAA Order 1600.54B	Automated Information Systems Security Handbook (Note: Applicable to DS legacy system components only.)
FAA Order 1600.6	Protection of Agency Property
FAA Order 1600.68	FAA Information Systems Security (ISS) Program (Note: Not applicable to DS legacy system components.)
FAA Order 1600.69	FAA Facility Security Management Program (Note: Not applicable to DS legacy system components.)
FAA Order 1800.58A	NAS Integrated Logistics Support
FAA Order 1810-6	Policy for Use of NDI in FAA Acquisitions
FAA Order 3900.19	Operating Environment Requirements
FAA Order 6000.15B	General Maintenance Handbook for Airways Facilities
FAA Order 6000.30B	Maintenance
FAA Order 6090.1A	Remote Maintenance Monitoring
FAA Order 6100.1	Maintenance of NAS En Route Stage A Air Traffic Control System
FAA Order 6650.9	Requirements for Area control Facility (ACF) Under the Floor Cabling, 10/8/91 (Note: Applicable to DS legacy system only)
FAA C-1217e	Electrical Work, Interior
FAA-P-1810, AIT-1 0494	FAA Acquisition and Program Risk Management Guidance – Volume 1: Chapter 7 – Risk Management in the Nondevelopmental Item (NDI) and Commercial Off-the-shelf (COTS) Arenas
FCC Class A	FCC Rules and Regulations, Volume II, Subpart J
IEEE-488	IEEE Standard Digital Interface for Programmable Instrumentation
MIL-C-28809B	Circuit Card Assembly, Rigid, Flexible, and Rigid Flex User
NFPA-70	National Fire Protection Agency
UL-1950	Underwriters Laboratory Safety Standards

3. REQUIREMENTS

3.1 System Description

The EDI will interface with the Host Computer System (HCS) and Direct Access RADAR Channel (DARC) systems to receive data for display and to send messages entered at ATC operational position. In addition, the EDI will interface with the Weather and RADAR Processor (WARP) system to receive and display NEXRAD reflectivity data at the R-Position. With the addition of the CP application to the EDI, RUC gridded wind data will also be sent from the WARP to the EDI.

In FFP1, the EDI will provide ARTCCs an interface to the HCS to support the requirements for two way communications between the HCS and the CP application. In addition, an interface to an external communication service provider to support ARTCC-to-ARTCC communications will be supported.

The CP information will be displayed at the D-Position to assist in strategic flight planning functions.

3.2 System Functional Characteristics

This section includes the functional requirements for the EDI and the CP application. The ATC applications requirements come first, followed by the infrastructure service requirements which support them. The system requirements including the CHI requirements for the ATC user community are also included along with the system services available to manage the EDI and the ATC applications. The section ends with the specification of the interfaces to the EDI and the system characteristics of the EDI.

3.2.1 Air Traffic Control Applications

3.2.1.1 Conflict Probe Functional Requirements

The Conflict Probe application is a new ATC function provided by URET CCLD that notifies the air traffic controller of potential aircraft-to-aircraft and aircraft-to airspace conflicts based on aircraft flight plan data. The CP application, or CP, will receive flight data from the local Host Computer System and from CP applications (CPs) in other facilities. Using flight data and wind data, CP will create a 4-dimensional representation of the flight path called a trajectory. Through conformance monitoring and reconformance, the trajectory will be updated based on track data from the Host. Trajectories also will be updated based on data from CPs in other facilities. CP includes capabilities for the controller to create and probe Trial Plans to check potential changes to the flight plan, to coordinate changes with other controllers, and to send flight plan amendments to the Host. CP provides an interface with the controller via the D-position operational display.

This section contains the functional requirements for CP, including the computer human interface requirements.

3.2.1.1.1 Flight Data Maintenance

The remainder of this subsection indicates the information and processing that is needed to establish and maintain flight data to be used for subsequent processing and information posting.

3.2.1.1.1.1 Flight Plan Processing

CP shall (DD2561) process Flight Plans received from the HCS.

CP shall (DD2562) process flight data received from neighboring CP systems.

All flight data for a flight shall (DD2563) be deleted a parameter time after whichever of the following occurs first:

a. Aircraft exits a parameter distance boundary (e.g., 200 miles) around the facility and the trajectory indicates the flight will not reenter the boundary.
b. The flight plan time type is still 'proposed' and the current time is a parameter time after the proposed departure time.
c. The HCS indicates the Plan has been deleted and the flight plan time type is still 'proposed'.
d. It is determined that the flight has reached it's destination (e.g., the trajectory indicates there are no remaining fixes).

The data received from a neighboring CP shall (DD2564) be deleted whenever a remote owning facility's CP indicates the Current Plan has been deleted.

3.2.1.1.1.2 Flight Plan Amendment Processing

CP shall (DD2566) amend the stored Flight Plan for a flight when CP receives Flight Plan amendment data from the HCS.

CP shall (DD2567) amend the flight data that has been received from a remote owning facility's CP when CP receives an amendment message from a neighboring CP.

3.2.1.1.2 Plan Maintenance

CP will accept, distinguish, process, store, and delete the following types of aircraft plans:

a. Current Plans (one per aircraft)
b. Trial Plans
c. Trial Plans submitted for Automated Replan (one per aircraft)
d. Trial Plans submitted for Automated Coordination (one per aircraft).

3.2.1.1.2.1 Current Plan Processing

CP accepts, stores, processes, and deletes data on Current Plans.

3.2.1.1.2.1.1 Initiation and Modification of Current Plans

A Current Plan for an aircraft shall (DD2573) be created upon receipt of valid Flight Plan information for that aircraft.

A Current Plan for a flight in a facility not owning the flight shall (DD2574) be constructed using the Flight Plan from the remote owning facility, if available.

A Current Plan for a flight in a facility not owning the flight shall (DD2575) be constructed using the Flight Plan from the HCS when interfacility flight data is not available.

A Current Plan for a flight in a facility owning the flight shall (DD2576) be constructed using the Flight Plan from the HCS.

CP shall (DD2577) modify Current Plans to reflect Flight Plan amendments.

3.2.1.1.2.1.2 Current Plan Deletion

A Current Plan shall (DD2579) be deleted when the Flight Plan used to build the Current Plan is deleted.

3.2.1.1.2.1.3 Current Plan Ownership

The ownership of the Current Plan shall (DD2581) correspond to the controlling sector and facility as indicated by track control of the aircraft.

Upon request from a remote CP, the transferring facility CP shall (DD2582) send the following information to the remote CP:

a. Aircraft ID / CID

b. CPs currently notified of the flight

When the ownership of a Current Plan is transferred from one CP to another CP, the new owner shall (DD4224) request the "CPs currently notified of the flight" from the previous owner.

The CP owning the flight shall (DD2583) notify other CPs indicated by the previous owning CP of the change in ownership and the new interfacility Current Plan.

3.2.1.1.2.2 Trial Plan Processing

CP will construct and maintain Trial Plans for the purpose of assessing conflicts involving proposed flight plans and changes to Current Plans.

A Trial Plan for an aircraft includes all data applicable to a flight, including the trajectory corresponding to the Trial Plan, the conformance bounds, and information essential for clearance delivery, plus amendment or other flight data constructed from controller input.

The system shall (D**) provide the capability to construct a trial plan that incorporates an applicable ATC Preferred Route.

3.2.1.1.2.2.1 Initiation of Trial Plans

CP will create a Trial Plan when (1) a controller uses single trial planning to select an existing plan (either a Current Plan or Trial Plan) and designates the desired amendments (or no change) to be applied, or (2) the controller has submitted a Trial Plan for Automated Replan and CP automatically recreates a new Trial Plan periodically, or (3) the controller Resubmits an existing Trial Plan (See 3.2.1.1.8), or (4) a remote owning facility's CP has transferred an existing Automated Replan to the new owning facility upon transfer of control for the purpose

of creating an Automated Replan, or (5) an interfacility coordination request is received, or (6) a user submits a proposed flight plan for probing.

3.2.1.1.2.2.2 Deletion of Trial Plans

CP shall (DD 2589) delete a Trial Plan when a controller at the position owning the Trial Plan designates it for deletion.

CP shall (DD 2590) delete a Trial Plan when the Plan from which the Trail Plan was derived is deleted.

CP shall (DD 2591)delete a Trial Plan when the Trial Plan is more than a parameter time old.

CP shall (DD 2593) delete the Trial Plan when Automated Replan processing terminates for the flight.

3.2.1.1.2.2.3 Trial Plan Output Data

CP shall (DD 2596) provide Trial Plan outputs at the position where the Trial Plan was created.

Notification that a Trial Plan has been deleted by other than controller action shall (DD 2597) be provided in the displayed Trial Plan.

CP shall (DD2820)(DD2598) provide Automated Replan output to the sector owning the Current Plan for the flight.

3.2.1.1.3 Trajectory Processing

CP provides trajectory processing for Current Plans, Trial Plans and Coordination Plans. A trajectory is a sequence of converted fixes and route segments, altitude data and time at fixes that describe the flight.

CP shall (DD 2605) construct a trajectory based on a route of flight, planned actions, adapted preferential routes, altitude and time data, weather data, and aircraft characteristics data. Types of planned actions include route changes, altitude changes, altitude restrictions, speed changes, and speed restrictions.

The system shall (DD**) provide the capability to define, in national adaptation, a planned holding area.

The system shall (DD**) provide the capability, in local adaptation, to define ATC Preferred Route (APR) eligible airports.

The system shall (D**) determine APR eligibility for each aircraft based on destination airport.

The system shall (DD**) provide the capability, in local adaptation, to define ATC Preferred Routes.

The system shall (D**) provide the capability, in local adaptation, to designate destination airports for which ATC Preferred Routes are eligible to be applied.

A Wrong Altitude for Direction condition exists at a predicted sector exit point for an aircraft when that aircraft's assigned altitude at that point is not allowable given its predicted course .

The system shall (D**) detect when a Wrong Altitude for Direction condition exists for an aircraft.

The following flight data shall (DD 2606) be required for CP to build a trajectory:

a. Aircraft ID
b. Aircraft type
c. Departure Point or Coordination Fix
d. Departure Time or Time at Coordination Fix
e. True Air Speed
f. Altitude
g. Route

CP shall (DD 2607) build a trajectory for each Plan except when any of the required data listed above is not available.

If an incomplete route indicator (XXX) appears in the route, the system shall (DD4239) terminate the route conversion at the previous fix.

If a route element is unrecognized within a portion of the route inside conterminous U.S. airspace, CP shall (DD4240) terminate route conversion at the previous fix and provide a conflict probe detected incomplete route indicator (for example YYY) for display with that flight plan.

For the portion or the route outside U.S. airspace, an unrecognized route element shall (DD2613) be discarded.

3.2.1.1.3.1 Route Segment Conversion

The route of flight shall (DD2609) be converted into a series of segments that make up the route across the surface of the earth.

For a flight for which CP has no track data the departure point is not followed by a tailoring symbol, CP shall (DD2610) convert the route beginning with the departure point as indicated in the collocated Host flight plan.

For a flight for which CP has no track data and the departure point in the collocated Host flight plan for a flight is followed by a tailoring symbol, the system shall (DD4222) convert the route beginning with the fix following the tailoring symbol or the Coordination Fix.

If track data is available in CP, route conversion shall (DD4144) begin with the track position of the aircraft.

If an interfacility Current Plan is available in CP, route conversion shall (DD4145) begin at the current position based on the interfacility Current Plan.

Route segment conversion shall (DD2611) be done by direct route processing, by application of adapted routes (such as airways, coded routes) or route segments, or by non-adapted arrival logic as determined from information in the Flight Plan.

CP shall (DD2612) perform validity checking on the route of flight in the flight plan.

CP shall (DD2614) accept ICAO aerodrome designators and FAA airport identifiers.

CP shall (DD2615) process connect fixes when the fix is for a destination airport; processing includes computation of the connect fix.

CP shall (DD2616) be capable of applying Preferential Arrival Routes, Preferential Departure Routes, and Preferential Departure Arrival Routes.

When the flight plan for a flight includes an estimated delay time for a fix, CP shall (DD2617) append a delay time to the flight's Current Plan trajectory beginning with that fix which is equal to the estimated delay time specified in the flight plan.

Upon user request to apply a Planned Holding Area to a Current Plan at the aircraft's present position, CP shall (DD2618) modify the aircraft's Current Plan trajectory to apply the requested Planned Holding Area at the most recent reported track position of the aircraft.

If a Planned Holding Area is applied to a fix that matches a fix with a delay, CP shall (DD2619) apply the PHA as designated by the user to the Current Plan's trajectory and not the delay.

Upon user request to cancel a Planned Holding Area for an aircraft, CP shall (DD2620) modify the Current Plan's trajectory to cancel the designated Planned Holding Area.

If a route-only flight plan amendment is received from the Host for an aircraft that is in hold, the system shall (DD**) terminate the hold for that aircraft.

CP shall (DD2621) apply altitude and speed restrictions to the trajectory at adapted restriction crossings based on destination airport, aircraft type, and active status of the restriction.

The system shall (DD4262) provide the capability to apply altitude and speed restrictions to the trajectory at adapted restriction crossings based on departure airport, aircraft type, and active status of the restriction.

The system shall (DD**) provide the capability to apply altitude and speed restrictions to the trajectory at adapted restriction crossings based on departure-destination airport pair, aircraft type, and active status of the restriction.

A time period of applicability shall (DD2622) be adapted with each restriction.

The restrictions shall (DD2623) be adapted as lines of one or more connected segments. These lines often correspond, but are not limited to, portions of terminal airspace, sectors, and airspace external to the facility airspace.

CP shall (DD2624) be able to apply all applicable restrictions to a single flight.

CP shall (DD2625) build trajectories that span its APD boundary.

The portion of a route within a neighboring facility shall(DD2626) be processed using the neighbor's adapted preferential routes and restrictions.

The portion of the route within the local facility shall (DD2627) be processed using the adaptation of the local CP facility.

The restriction status shall (DD2628) be maintained for each restriction that indicates whether the restriction is active, inactive, or following the adapted on/off times schedule.

At CP cold start, the status of a restriction shall (DD2630) be set to follow the adapted schedule.

User override of the activation status of a restriction shall (DD2631) force an update of all relevant trajectories.

Trajectory modeling shall (DD2632) apply applicable restrictions if the restriction has been manually activated or the restriction is scheduled to be active at the time the trajectory crosses the restriction.

CP shall (DD2633) provide a capability to remove, by manual input, the application of a selected restriction for a Current Plan or Trial Plan. CP shall (DD2634) provide a capability to manually impose application of an inactive restriction to a Current Plan or Trial Plan. CP shall (DD2635) provide a capability to return a flight to normal restriction application rules. Once a manual action has been taken to remove or impose a restriction, it shall (DD2636) persist until another action for that restriction is taken or a system cold start. If the removal/imposition is invoked on the aircraft's Current Plan, then it shall (DD2637) apply to all plans subsequently created from that Current Plan for the aircraft. If the removal/imposition is invoked on a Trial Plan, then it shall (DD2638) only apply to that plan. CP shall (DD2639) provide the capability to apply the removal/imposition of a restriction invoked on a Trial Plan to the Current Plan. The manual action shall (DD2640) result in recalculation of the trajectory for the selected Current Plan or Trial Plan.

When CP receives a route status message, CP shall (DD2641) change the active and inactive status of all preferential routes as indicated by the message.

The new activated preferential routes as a result of the route status message shall (DD2642) be applied to the next trajectory generation for a flight that is a consequence of a Current Plan creation or a Current Plan amendment (not because of a reconformance).

Preferential routes applied to Trial Plans shall (DD2643) be based upon status of the preferential routes when the Trial Plan is processed.

CP shall (DD2644) process direct route segments from end-point to end-point for lengths up to 4000 nautical miles.

It shall (DD2645) be possible for each end-point to be located outside of the airspace controlled by the facility.

Upon user request to apply a Planned Holding Area to a Current Plan at a designated fix, the system shall(DD**) modify the Current Plan's trajectory to apply the requested Planned Holding Area at the designated fix.

Upon user request to apply a Planned Holding Area to a Current Plan at a designated location along the predicted route of flight for that Plan, the system shall(DD**) modify the Current Plan's trajectory to apply the requested Planned Holding Area at the designated location.

An aircraft is considered APR eligible when a) the destination airport for the aircraft has been adapted as ATC Preferred route eligible and b) the applicable adapted ATC Preferred route strings for the destination airport are not part of the route field in the aircraft's Current Plan.

The system shall (DD**) provide the capability to determine eligibility for ATC Preferred Route application based on destination.airport. Subsequently, the system shall (D**) determine eligibility for ATC Preferred Route application based on aircraft type, filed true air speed, Altitude, filed transition fix, and published schedule.

The system shall (D**) calculate end points of radial-route segments when the radial-route segment is included as a route element in an ATC Preferred Route.

3.2.1.1.3.2 Altitude Conversion

A vertical profile shall (DD2647) be built for a flight using:

a. The requested or assigned altitude in the Flight Plan
b. An interim altitude active for the flight
c. Altitude restrictions applicable for the flight
d. Climb and descent gradients from aircraft characteristics
e. Weather data (wind and temperatures aloft)
f. Observed altitude transition rates
g. Observed altitude

When the type of time contained in a flight plan is a P-time or F-time, the vertical profile shall (DD2648) be based on the Assigned Altitude, or the Requested Altitude if there is no Assigned Altitude, altitude restrictions, aircraft characteristics, and weather data.

When the type of time contained in a flight plan is a D-time or E-time, the vertical profile shall (DD2649) be influenced by the observed altitude transition rates, actual altitude position from the track data, and any Interim Altitude active for the flight.

CP shall (DD2650) generate trajectories when the assigned altitude is in the form altitude-fix-altitude.

Whenever the trajectory is recalculated because of a reconformance or flight data amendment, the observed altitude transition rate shall (DD2651) be used to recalculate the vertical profile.

The observed altitude shall (DD2652) be used as the starting altitude when modeling the trajectory as a result of a flight data amendment.

When an interim altitude or assigned altitude is received while the flight is in the cruise or arrival phase of flight, the trajectory shall (DD2653) be modeled to transition to the received altitude starting after a parameter distance.

When an aircraft in climb with an interim altitude reaches that interim altitude, the system shall (DD4263) modify the aircraft's Current Plan trajectory to model the aircraft as level for a parameter distance.

If a climb is not detected when the aircraft modeled as level at the interim altitude is predicted to resume its climb, then the system shall (DD**) modify the aircraft's Current Plan trajectory to model the aircraft as level for another parameter distance.

When an interim altitude is cancelled for an aircraft that is modeled at an interim altitude, the system shall (DD4264) modify the aircraft's Current Plan trajectory to terminate the interim altitude and resume the climb.

When the track history of an aircraft at an interim altitude indicates that the aircraft is climbing, the system shall (DD4265) modify the aircraft's Current Plan trajectory to terminate the interim altitude and resume the climb.

When the aircraft is in its arrival phase, the trajectory shall (DD2654) model the flight to start the descent as late as possible, using nominal descent values, yet still apply applicable altitude restrictions and land the aircraft at its destination.

An aircraft with Blocked Altitude assigned shall (DD2657) be modeled at the top of the altitude block.

If an altitude amendment is received from the Host for an aircraft that is in hold, the system shall(DD**) change the size of the Planned Holding Area to include the vertical transition to the new altitude.

3.2.1.1.3.3 Fix Time Calculation

The Calculated Time of Arrival (CTA) shall (DD2659) be calculated for each Converted Fix.

The calculation shall (DD2660) take into account the converted route segments, the vertical profile, planned speed, aircraft characteristics data, and weather data.

If a Planned Holding Area is not designated for a fix and a delay is specified for that fix in the Flight Plan, CP shall (DD2661) use that Flight Plan delay data when computing the Calculated Time of Arrival for fixes.

3.2.1.1.3.4 Use of Aircraft Characteristics

CP shall (DD2663) store and use generic aircraft characteristics data for aircraft type and atmospheric temperature.

Generic characteristics data shall (DD2664) include climb and descent performance, maximum and minimum speeds, and maximum endurance speeds

CP shall (DD2665) use these generic characteristics as an envelope providing nominal, maximum, and minimum values for calculating trajectories.

Nominal climb and descent values shall (DD2666) be used to model trajectories unless altitude restrictions along the route cannot be met using these values.

If an altitude restriction cannot be met, the maximum climb or descent values shall (DD2667) be used.

For reconformance, CP shall (DD2668) determine the speed of the flight using a weighted average of track reported speed for that flight and nominal speed for that flight.

Also for reconformance, the observed altitude transition rate for climbs shall (DD2669) be used as input when calculating the gradient even when altitude restrictions cannot be met.

3.2.1.1.3.5 Use of Weather Data

CP shall (DD2671) use winds and temperatures aloft data and barometric pressure data to adjust aircraft filed speeds and rate of ascent or descent.

3.2.1.1.4 Track Data Processing

Track data is used to: determine whether a flight is in conformance with its current plan trajectory (see Conformance Monitoring, 3.2.3.1.5), and reconform (see Reconformance, 3.2.3.1.6) the current plan trajectory as needed.

3.2.1.1.4.1 Pairing Track Data With Flight Plan Data

CP shall (DD2675) pair track data received for a flight with a Current Plan for that flight using flight identification information.

CP shall (DD2676) match the aircraft position for a flight as received in track data to a related portion of the associated Current Plan trajectory for that flight.

If a new flight plan is received for a flight whose track data is not paired with a flight plan for that flight, CP shall (DD2678) pair the track data in the track history for that flight to the received Flight Plan for that flight.

3.2.1.1.4.2 Flight Categories

CP classifies flights into categories based on the track data being received. The supported flight categories are defined as follows:

A flight is considered to be a category A flight if the flight has a Current Plan trajectory, is not a category G flight and continuous, reasonable track data is being received for that flight.

Track data for a flight is received on a periodic basis. Track data for a flight is considered continuous if the consecutive current and prior two track reports are reasonable or there are no more than a system parameter of unreasonable or missing data points within a system parameter maximum number of latest received track reports.

Track data for a flight is considered reasonable when the following criteria are satisfied:

a. The track report received for that flight is the first track report for that flight and the altitude is positive.

b. The track data received for that flight is not the first track report for that flight and the horizontal distance flown from the aircraft position associated with the most recent reasonable track data in the track history for that flight to the current aircraft position associated with the track data received for that flight is within an adapted multiple of the expected horizontal distance the flight could travel given aircraft characteristics.

c. The track data received is not the first track data for that flight and the altitude transition from the aircraft position associated with the most recent reasonable track data in the track history for that flight to the current aircraft position associated with the track data received for that flight is within an adapted maximum altitude transition.

A flight is considered to be a category B flight if the flight has a Current Plan trajectory and intermittent or sporadically unreasonable track data is being received for that flight (more than a system parameter number of unreasonable or missing track data reports exist within the track history for that flight),

A flight is considered to be a category C flight if no track data has been received for that flight and the departure or coordination time is marked as Proposed ("P") which indicates that the flight has not yet departed.

A flight is considered to be a category D flight if there is a Current Plan trajectory for the flight and the flight is in hold.

A flight is considered to be a category E flight if there is no Current Plan trajectory for the flight.

A flight without an interfacility Current Plan from a remote facility is considered to be a category F flight if there is a Current Plan trajectory for the flight and no track data has been received for the flight and the Flight Plan coordination time is marked as Estimated ("E") or Departed ("D"); i.e., the flight is inbound from another facility.

A flight without an interfacility Current Plan from a remote facility is considered to be a category G flight if there is a Current Plan trajectory for the flight and the flight has crossed the boundary into an outbound facility and has been handed off to that facility.

Upon receipt of track data or a new Flight Plan for a specific flight, CP shall (DD2690) assign the appropriate Flight Category to that flight.

Upon receipt of a hold message, CP shall (DD2691) assign the appropriate flight category.

If track data for a flight that has a Current Plan trajectory is not received at the expected adapted interval, CP shall (DD2692) assign that flight to the appropriate flight category.

For aircraft with Current Plans based on Flight Plans from a remote owning facility's CP, the Flight category status shall (DD2693) be defined as Category F, unless the trajectory cannot be modeled in the local system.

Unless adapted as not eligible for APD, a Flight Plan or Current Plan shall (DD2694) be defined as APD Eligible (i.e. eligible for problem prediction) for aircraft in Category A that are not greater than a parameter distance from their filed route (Far Away), Category B, and inbound flights that are Category F. Flights with adapted characters in the assigned altitude field and adapted as not eligible for APD, shall (DD2695) be processed by CP as not eligible for APD.

APD Eligibility for the Category F interfacility flights shall (DD2696) be determined by directives received from the remote owning facility's CP.

The owning facility's CP shall (DD2697) send APD Eligibility information for that flight to the affected CPs.

The system shall (DD**) send the flight category for a flight to affected CPs.

3.2.1.1.4.3 Reasonableness Checking

CP provides reasonableness checking on the track data.

CP shall (DD2700) discard track data that are beyond the physical limitations of the aircraft as set in adaptation.

Unreasonable track data received for a flight shall (DD2701) be maintained for later categorization of that flight.

3.2.1.1.4.4 Track History

CP shall (DD2703) retain a system parameter history of flight track positions, altitudes, and times for a flight.

Using the track history for a flight, CP shall (DD2704) compute and maintain the following aircraft–specific values for that flight:

a. Observed altitude transition rate

b. Observed speed

When flight control for a flight is offered to the receiving facility as determined from HCS data, the owning CP for that flight shall (DD2705) send the Track History data for that flight to the receiving CP for that flight.

If local HCS track data is not available for a flight the receiving CP shall (DD2708) request the track data for that flight from the owning CP for that flight.

While the handoff offer for a flight remains unaccepted, the owning CP for that flight shall (DD2709) send the track data for that flight to the receiving CP for that flight.

The receiving CP shall (DD2710) update the Track History from the received track data unless track data is available from the local HCS.

3.2.1.1.5 Conformance Monitoring

Conformance Monitoring determines when a flight is not in conformance laterally, vertically, or longitudinally with the predicted aircraft position for that flight as defined in that flight's Current Plan trajectory (hereafter referred to as non-conformance).

CP shall (DD2715) adjust lateral conformance criteria for a flight to account for the accuracy of the aircraft's filed navigational equipment (e.g., RNAV).

CP shall (DD2716) adjust lateral conformance criteria used for turns in a flight's route to account for additional airspace required to complete the turn.

CP shall (DD2717) adjust vertical conformance criteria used for vertical transitions in a flight's route to account for additional airspace required to complete the transition.

The vertical conformance criteria for an aircraft with a Blocked Altitude assigned shall (DD2718) include all altitudes between the lower altitude of the block less the adapted conformance criteria and the upper altitude plus the adapted conformance criteria.

CP shall (DD2719) readjust the Conformance criteria for a flight whenever a change affecting that criteria is made.

Upon determination that a flight is in flight category A, CP shall (DD2720) compare the Current Plan trajectory-predicted position of that flight with the reported aircraft position for that flight.

CP shall (DD2721) declare a nonconformance condition for a flight when the flight is a category A flight that is not inside an active Tactical airspace and a parameter number (by dimension) of aircraft positions received from the Host for that flight are not in lateral, longitudinal, or vertical conformance with the predicted aircraft position for that flight .

3.2.1.1.6 Reconformance

Reconformance attempts to re-model a route of flight once conformance monitoring detects that a flight is no longer in conformance with its filed route of flight. Conformance Monitoring detects the following kinds of lateral nonconformance:

a. The aircraft is shortening its route by going direct to a downstream fix

b. The aircraft is shortening its route by cutting a corner

c. The aircraft is converging toward its route (e.g. when first active, or if the aircraft is making a vector maneuver and is now returning to route)

d. The aircraft is diverging from the route when no other nonconformance case applies (default case)

e. The aircraft's current position is greater than a parameter distance away from the route of the flight plan (referred to as "Far Away from Route").

Conformance Monitoring detects the following kinds of longitudinal nonconformance:

a. An aircraft is sufficiently ahead or behind its predicted position that it is outside the conformance region.

Conformance Monitoring detects the following kinds of vertical nonconformance:

a. The flight's Current Plan trajectory calls for level flight, and the flight drifts, vertically, violating its conformance criteria (referred to as vertical drift).

b. An altitude transition is expected for the flight based on its Current Plan trajectory and that transition is not performed on time, i.e., is late, or is performed early.

c. The flight is in vertical transition to a new altitude and violates its conformance criteria.

When a nonconformance condition is detected in the lateral dimension for a flight and the track position for that flight is not more than a parameter distance in the lateral dimension from the aircraft position for that flight on its filed route, CP shall (DD2726) reconform the Current Plan trajectory for that flight in the lateral, vertical (when the flight is in vertical transition) and longitudinal dimensions based on the track position.

When a nonconformance condition is detected in the longitudinal dimension for a flight, CP shall (DD2727) reconform the Current Plan trajectory for that flight in the vertical (when the flight is in vertical transition) and longitudinal dimensions based on the track position for that flight received .

When a nonconformance condition is detected in the vertical dimension for a flight and the flight is in vertical transition, CP shall (DD2728) reconform the Current Plan trajectory for that flight in the vertical and longitudinal dimensions based on the track position for that flight.

When a non-conformance condition is detected in the vertical dimension for a flight and that flight is inbound from a facility without CP running, CP shall (DD2729) reconform the Current Plan trajectory for that flight in the vertical and longitudinal dimensions based on the track position.

When a flight is reconformed in the lateral dimension, the Current Plan trajectory for that flight shall (DD2730) be modified to include a transition from the current aircraft position for that flight to a downstream position on the filed route for that flight based on the type of nonconformance detected.

The stability of the track course, type of nonconformance, and set of eligible return-to-route points (clearable fixes and extrapolated track/route intersection points) are considered when choosing the specific route amendment to create when reconforming the Current Plan trajectory for a flight. A track history is considered stable if it contains an adapted minimum number of reasonable track reports.

A fix is considered an eligible return-to-route point if the fix identifier is a three character alpha-numeric fix name, a five character fix (no numerics) name, a turn fix, or a fix in the flight plan route field.

When lateral reconformance for a flight is required, CP shall (DD2733) reconform that flight without modifying the displayed flight plan route field associated with that flight.

When a flight is reconformed in the vertical dimension and the flight is not currently in a vertical transition, the Current Plan trajectory for that flight shall (DD2734) be modified to include a vertical maneuver from the current aircraft position for that flight to the filed route for that flight using associated aircraft performance characteristics for that flight.

When a flight is reconformed in the vertical dimension and the flight is performing a vertical transition, CP shall (DD2735) modify the Current Plan trajectory for that flight to include the remaining portion of the vertical transition from the current aircraft position for that flight to the filed route for that flight using the automation-calculated altitude transition rate (based on the observed altitude transition rate for the flight) instead of a generic altitude transition rate based on associated aircraft performance characteristics.

When a flight is to be reconformed in the longitudinal dimension, CP shall (DD2736) modify the Current Plan trajectory for that flight to include an automation-calculated speed transition (based on observed speed) for that flight starting from the current aircraft position for that flight and terminating with the next planned speed maneuver for that flight.

When the Current Plan trajectory for a flight is reconformed to its filed route of flight, the owning CP for that flight shall (DD2737) send the conformance information for that flight to each remote CP whose APD boundary includes that flight.

Upon receiving notification of reconformance for a flight owned by a neighboring CP, the receiving CP shall (DD2738) reconform the Current Plan trajectory for that flight in the same dimensions using the information received from the owning CP.

3.2.1.1.7 Automated Problem Detection

CP provides an APD Capability for Trajectories of Current Plans and Trial Plans.

The types of problems which will be detected include the following:

a. Aircraft-to-aircraft problems - predicted violation of separation minima applied to aircraft Trajectories and predicted violations of separation minima between aircraft Trajectories and Planned Holding Areas.

b. Aircraft-to-airspace problems - predicted violation of separation minima between aircraft Trajectories and Planning Region Airspaces.

When a Trial Plan is checked for problems and no conflicts with other flights or airspaces are detected, a response indicating that no conflicts with other flights or airspaces exist shall (DD2742) be displayed.

When a Trial Plan is checked for problems and a conflict is detected with another flight or airspace, a Trial Plan Alert indicating the existence of a conflict with another flight or airspace shall (DD2743) be displayed.

CP shall (DD2744) use adapted separation criteria for the flight in the airspace when checking for problems.

Volumes of airspace shall (DD2745) be adapted with values for the basic separation standard to be used in that airspace.

Required separation shall (DD2746) be increased by a parameter amount when a flight contains more than one aircraft.

In checking aircraft with Blocked Altitude assigned, CP shall (DD2747) protect all altitudes between the lower altitude limit of the block less the conformance and adapted separation criteria and the upper altitude limit of the block plus the conformance and adapted separation criteria.

CP shall (DD2748) detect conflicts between an APD eligible flight and another APD eligible flight or airspace using separation and conformance criteria calculated for that flight.

CP shall (DD2749) be capable of applying different separation criteria to a Trial Plan than separation criteria applied to Current Plans.

CP shall (DD2750) be capable of applying different separation criteria to a Trial Plan between the aircraft's current position and a parameter time past the start point of the first maneuver than separation criteria applied to the rest of the Trial Plan.

CP shall (DD2751) inhibit problem detection between Plans for the portion of those flights that are within adapted volumes of airspace designated as active Automated Problem Detection Inhibited Areas (APDIAs).

CP shall (DD2752) provide a capability to activate deactivate or reconfigure an APDIA and associated Tactical Airspace based upon Sector Assignment Status (SH) messages received from the local Host.

When an APDIA's status/configuration changes, CP shall (DD2755) update alert notifications to correspond to the new APDIA and associated Tactical Airspace status/configuration.

Each APDIA and associated Tactical Airspace consists of one or more adjoining FPAs designated as approach control FPAs.

CP shall (DD2757) inhibit problem detection when an aircraft's current position based on track data is within a Tactical Airspace.

CP shall (DD2761) check for aircraft-to-aircraft conflicts and aircraft-to-airspace conflicts in a Current Plan trajectory for APD eligible flights when:

a. A Current Plan trajectory is created or modified (e.g., the Current Plan is replaced or reconformed).
b. The flight becomes APD eligible.
c. The flight is assigned to a Planned Holding Area.
d. A Planned Holding Area is terminated.

CP shall (DD2762) check a Trial Plan trajectory against all APD-eligible Current Plan trajectories for aircraft-to-aircraft conflicts when the Trial Plan is created.

CP shall (DD2763) check a Trial Plan trajectory for aircraft-to-airspace conflicts when the Trial Plan is created.

3.2.1.1.7.1 Detection of Aircraft-to-Aircraft Conflicts

CP shall (DD2765) check each APD Eligible Current Plan trajectory and assigned Planned Holding Areas, if any for those aircraft, against all other APD eligible Current Plan Trajectories to detect aircraft-to-aircraft conflicts.

The system shall (DD**) check each APD-eligible Current Plan trajectory against all assigned Planned Holding Areas to detect aircraft-to-aircraft conflicts.

CP shall (DD2766) check for aircraft-to-aircraft conflicts only within the APD boundary of the facility.

The likelihood of a conflict will be calculated based on the error distributions related to future position predictions as defined in adaptation. The resulting likelihood value will be used to determine a warning time.

CP shall (DD2769) determine a warning time for aircraft-to-aircraft conflicts in the Current Plan based on the estimated likelihood of a predicted conflict.

Parameters for conversion of likelihood to warning time shall (DD4146) be adaptable.

CP shall (DD2770) compute a notification time to be equal to the start-of-conflict-time minus the warning time.

CP shall (DD2771) display an Alert for aircraft-to-aircraft conflicts in Current Plans at the later of the current time and the notification time, if the conflict is still predicted to occur at that time.

Current Plan alerts shall (DD2772) be assigned to a designated position.

Determination of the designated position where Current Plan alerts are assigned shall (DD2773) be made by applying the first applicable rule from the following list:

a. The location of both flights at the predicted start time of the conflict lie within a single sector. The designated position is the position controlling that sector.
b. The location of both flights at the predicted start time of the conflict lie in different sectors, and exactly one of those sectors is controlled by a position which is the owner of the Current Plan of one of the involved aircraft. The designated position is the position which owns the Current Plan of the involved aircraft and which also controls the location of the point of violation.
c. The location of both flights at the predicted start time of the conflict lie in different sectors, and exactly one of those sectors contains the intersection of the involved aircraft's' trajectories. The designated position is the position controlling the sector containing the intersection.
d. The location of both flights at the predicted start time of the conflict lie in different sectors, and the position controlling one of those sectors will own the corresponding

aircraft before the position controlling the other sector will own the second aircraft. The designated position is the position that will own an aircraft earliest.

e. The designated position is a position controlling one of the sectors where the flights are located at the predicted start time of the conflict.

When two sectors are involved, and only one sector is a sector with Conflict Probe operating, then the designated position shall (DD2775) be the sector with Conflict Probe operating.

When only one initial point of violation for a conflict is within the local ARTCC, then the system shall (DD**) select the sector in the local ARTCC in which that initial point of violation occurs as the designated position.

If at the time of notification, the designated sector position for a conflict notification is the previous controlling sector position of exactly one of the aircraft involved in that conflict and the controlling sector position for that aircraft is within the local ARTCC, the system shall (DD4269) change the designated sector position for conflict notification to the controlling sector position for that aircraft.

If at the time of notification, the designated sector position for a conflict notification is the previous controlling position for both aircraft involved in that conflict, the system shall (DD**) change the designated sector position to a controlling sector position within the local ARTCC for one of the aircraft involved in the conflict, if one exists.

If a conflict is being notified to a previous controlling sector position and an aircraft involved in that conflict is handed off to another sector position within the local ARTCC, the system shall (DD4270) change the designated sector position for conflict notification to the controlling sector position of that aircraft.

CP shall (DD2776) display for each predicted aircraft-to-aircraft conflict, conflict criticality based on the calculated horizontal minimum miss distance between predicted aircraft positions.

CP shall (DD2777) inhibit conflict notification for conflict detection of Trial Plans when the horizontal minimum miss distance between trajectories is greater than a parameter distance and the duration of the conflict is less than a parameter time.

When an immediate conflict is detected and the horizontal point-of-closest-approach is predicted to occur earlier than a parameter time in the future from the current time, CP shall (DD2778) inhibit conflict notification.

CP shall (DD2779) be able to disable the capability to inhibit immediate conflict notification as determined by a system parameter.

CP shall (DD2780) inhibit conflict notification for an aircraft pair when both aircraft have destination airports within a set of adapted airports and the initial points of violation are within a set of sectors adapted for the airport set. This capability is referred to as the Arrival Stream Filter.

CP shall (DD4274) provide the capability to activate or deactivate an Arrival Stream Filter for a sector position.

When an Arrival Stream Filter status changes, CP shall (DD4275) provide for display an update to the conflicts detected due to the Arrival Stream Filter.

CP shall (DD2781) check Trial Plans a parameter time into the future.

3.2.1.1.7.2 Detection of Aircraft-to-Airspace Conflicts

CP shall (DD2783) check for predicted violations of separation minima between trajectories of APD Eligible Current Plans and Planning Region Airspaces of the facility performing the check.

CP shall (DD2784) check for predicted violations of separation minima between trajectories of Trial Plans and Planning Region Airspaces of the facility performing the check. Predicted violations of separation minima involving aircraft and Planning Region Airspaces are termed airspace conflicts.

CP shall (DD2785) check trajectories to the point of flight termination or to the Planning Region boundary, whichever occurs first, for airspace conflicts with Planning Region Airspaces.

The separation minima used in checking for conflicts shall (DD2786) be adapted with the airspace definition.

When an aircraft-to-airspace conflict is detected in a Current Plan, the position that owns the Plan with the problem shall (DD2787) be designated for assignment of the problem.

CP shall (DD2788) provide notification of aircraft-to-airspace conflicts when the current time is within an adaptable time in advance of the predicted start time of conflict. If at the time of the detection, the start time of predicted aircraft-to-airspace conflict precedes the current time and the predicted aircraft-to-airspace conflict end time does not precede the current time, then CP shall (DD4225) provide notification of the aircraft-to-airspace conflict.

A Planning Region Airspace may be active or inactive. Activation/deactivation status shall (DD2790) be determined based on schedule for each airspace unless manually overridden. CP shall (DD2791) accept manual inputs to make an airspace active, to make an airspace inactive, to modify the schedule, to return it to the adapted schedule, or to return it to the modified schedule. CP shall (DD2792) also accept manual inputs to modify the altitude limits of an airspace. Changes in activation status or altitude limits shall (DD2793) be allowed only by the controlling facility (as determined by adaptation) for an airspace.

An aircraft to airspace conflict shall (DD2794) be notified if the associated airspace has been manually activated or is scheduled to be active during the predicted conflict time. Changes in the activation status, airspace schedule, or altitude limits of an associated airspace shall (DD2795) cause updating of the aircraft-to-airspace conflict notification for that airspace.

Changes in activation status, schedule, or altitude limits of an airspace shall (DD2796) be sent to neighboring facilities.

3.2.1.1.8 Trial Planning

CP will construct Trial Plans through the following functions:

a. Single Trial Planning
b. Automated Replan
c. Trial Plan Resubmit

In the following subsections, the "base plan" is defined as the Current Plan or Trial Plan that the user designates as a basis for building Trial Plans.

3.2.1.1.8.1 Single Trial Planning

CP shall (DD2800) allow the controller to create a Trial Plan, based on either a Current Plan or a Trial Plan, by designating no change to the Plan or by amending one or more of the following fields:

a. Assigned altitude

b. Assigned speed

c. Route

CP shall (DD2800) allow the controller to create a Trial Plan, based on either a Current Plan or a Trial Plan, by imposition/removal of a restriction.

When an altitude amendment is specified with a user selected starting point, CP shall (DD2801) construct a Trial Plan which incorporates an altitude change starting at a user selected point along the route, based on Current Plan trajectory of the aircraft.

When an altitude amendment is specified without a user selected starting point, CP shall (DD4147) construct a Trial Plan which incorporates an altitude change starting at a default adaptable amount of time after the current time, based on the Current Plan trajectory of the aircraft.

CP shall (DD2802) allow Trial Plan amendments that incorporate multiple altitude maneuvers at user selected points along the route of flight (e.g. step climbs as entered via the graphic trial plan capability).

When a speed amendment is specified, CP shall (DD2803) construct a Trial Plan which incorporates a speed change starting at a parameter amount of time after the current time, based on the Current Plan trajectory of the aircraft. The Trial Plan need not include a maneuver to return to the original speed.

When a route amendment is specified with a user entered starting point, CP shall (DD2804) construct a Trial Plan which incorporates one or more controller entered points, fixes, or airways starting at the user entered position.

When a route amendment is specified without a user entered starting point, CP shall (DD4148) construct a Trial Plan which incorporates one or more controller entered points, fixes, or airways starting at a position which is a default parameter amount of time after the current time based on the Current Plan trajectory of the aircraft.

The Trial Plan shall (DD2805) include a maneuver to return to the original route at the first downstream fix (three character, five character or turn fix) along the original route past the last entered point.

CP shall (DD2806) provide the user with the capability to override application of preferential routes through the use of Trial Plan route designations.

A Trial Plan problem is defined as the loss of separation between the trajectory of the subject of the Trial Plan and the trajectory of the object of the Trial Plan. CP shall (DD2807)

determine that the displayed Trial Plan's problem is invalid when one of the following conditions have occurred:

a. The Current Plan trajectory of the subject aircraft in the Trial Plan has changed
b. Current Plan trajectory of an object of the Trial Plan problem has changed so that the conflict has moved in time by greater than a parameter time, or the severity coding for the conflict has changed
c. The Current Plan trajectory of an object of the Trial Plan problem has changed such that it is no longer in conflict with the subject of the Trial Plan
d. The Current Plan trajectory of another aircraft has changed to create a conflict with the subject of the Trial Plan

3.2.1.1.8.2 Automated Replan

3.2.1.1.8.2.1 Amendment Designation

CP shall (DD2810) allow a user to designate that a change to a Current Plan is to be processed by Automated Replan by naming an already-existing Trial Plan which is owned by the position and describes the desired change.

CP shall (DD2811) also accept and process Automated Replan information sent from a remote owning facility to the local facility.

Only the sector position that controls the subject aircraft shall (DD2814) be able to initiate or terminate Automated Replan processing for that aircraft.

Upon entry of an additional Automated Replan request for a given aircraft, CP shall (DD2815) reject the new request and provide a notification that an Automated Replan request already exists for the aircraft.

The system shall (DD**) provide the capability for a user which initiated an automated replan for an aircraft to designate transfer of Automated Replan information to an accepting sector position within the local ARTCC upon transfer of track control for that aircraft to that sector position.

The system shall (DD**) provide the capability for a user which initiated an automated replan for an aircraft to designate transfer of Automated Replan information to an accepting sector position in a neighboring ARTCC upon transfer of track control for that aircraft to that ARTCC.

If transfer of Automated Replan information for an aircraft is not designated, Automated Replan information will not be sent upon transfer of track control for that aircraft.

When track control is transferred to a remote owning facility and an Automated Replan request exists for the aircraft, CP shall (DD2816) send Automated Replan information to the now owning facility's CP.

3.2.1.1.8.2.2 Processing

When a Trial Plan is accepted for Automated Replan processing, Automated Replan will be invoked for the aircraft which is the subject of the Trial Plan.

Upon evocation of Automated Replan, CP shall (DD2819) initially create a new Trial Plan based on the original Trial Plan using the present position of the subject aircraft and the modifications stated in the Trial Plan.

Upon evocation of Automated Replan, CP shall (DD4149) submit the newly created Trial Plan to APD for problem detection.

CP shall (DD4150) periodically remodel and re-probe a Trial Plan created by Automated Replan at an adaptable interval until Automated Replan terminates.

CP shall (DD2820)(DD2598) notify the position that owns the Current Plan being processed by Automated Replan of the results of each re-probe.

CP shall (DD2821) determine that the displayed Automated Replan conflict information is invalid, and resubmit the Trial Plan to probing, when one of the following conditions have occurred:

a. The Current Plan trajectory of the subject aircraft in the Trial Plan has changed.
b. The Current Plan trajectory of an object of the Trial Plan problem has changed so that the conflict has moved in time by greater than a parameter time, or the severity coding for the conflict has changed.
c. The Current Plan trajectory of an object of the Trial Plan problem has changed such that it is no longer in conflict with the subject of the Trial Plan.
d. The Current Plan trajectory of another aircraft has changed to create a conflict with the subject of the Trial Plan.

3.2.1.1.8.2.3 Termination

Automated Replan shall (DD2823) terminate for an aircraft when any one of the following conditions is met:

a. The Current Plan is deleted.
b. A user at the controlling position manually terminates Automated Replan for the aircraft.
c. The Trial Plan created for Automated Replan is no longer valid.

Upon resubmittal, CP shall (DD2826) construct a new Trial Plan based on the amendment(s) that were designated for the Trial Plan being resubmitted.

If the maneuver start point of the base Trial Plan was determined by a system parameter, then CP shall (DD2827) recompute the maneuver start point for the new Trial Plan.

3.2.1.1.9 Trial Plan Description Processing

CP will display text and symbols which describe the modifications made in a Trial Plan whenever the Trial Plan is displayed.

CP shall (DD2830) display a description of the Trial Plan for only the new or changed part of the trajectory.

The Trial Plan description shall (DD2833) include the sector owning the subject of the Trial Plan when the Trial Plan is created by a position which does not currently own the aircraft.

The Trial Plan description shall (DD2834) include a facility when the aircraft is owned by another facility.

CP shall (DD2835) convert a geographic point input by the controller into fix radial distance form in the Trial Plan description.

The fix used to compute fix radial distance shall (DD2836) be the closest adapted 3 character fix from where the point is located.

3.2.1.1.10 Sectorization

CP airspace will be subdivided into fix posting areas (FPAs).

CP shall (DD2839) map FPAs to logical positions as determined from messages received from the Host.

Aircraft list entries and Conflict Probe alerts shall (DD2840) be routed to logical positions based on the mapping of airspace to logical positions.

CP receives and processes unsuccessful transmission messages from the Host for an aircraft when an indication of such a transmission failure would appear as a red coordination indicator on a flight progress strip for that aircraft. The system shall (DD**) route unsuccessful transmission message indications to the sector position indicated in the supplemental flight plan information message received from the Host.

3.2.1.1.11 Host Amendment Processing

The system will display Host responses to submitted amendment, flight plan, or interim altitude messages. The system will be capable of creating and submitting Host-formatted amendments messages based on a Trial Plan. The system will also be capable of creating and submitting Host-formatted interim altitude messages based on a Trial or Current Plan.

CP shall (DD2842) provide the capability to generate a Host-formatted Amendment messagefrom a Trial Plan except for altitude and speed changes occurring a parameter time in the future.

At a minimum, the following flight plan fields shall (DD2844) be amendable: speed, assigned altitude, route, coordination fix, and coordination time.

Within the route, lat/longs within a fix posting area that have a focal point fix defined shall (DD2845) be represented as fix radial distance from the focal point fix.

The fix posting area shall (DD2846) be determined using the assigned altitude.

The coordination fix shall (DD2847) be represented as fix radial distance from the focal point fix of the fix posting area in which the coordination fix is located.

If not in an adapted fix posting area, then the coordination fix shall (DD2848) be represented as lat/long.

CP shall (DD2849) provide the controller an option to add the eligibility override indicator to the message.

Upon receipt of a user request to send a Host-formatted amendment message to the Host, the system shall (DD2850) send the designated message to the Host.

When a Host formatted amendment message is sent to the Host, the system shall (DD2851) delete the associated Trial Plan.

The system shall (D**) provide the capability to generate a Host-formatted interim altitude message from a Trial Plan, except for an altitude change occurring after an adaptable time in the future.

The system shall (D**) provide the capability to generate a Host-formatted interim altitude message from a Current Plan.

The system shall (DD**) provide the user with an option to add the eligibility override indicator to a Host formatted interim altitude message.

Upon receipt of a user request to send a Host-formatted interim altitude message to the Host, the system shall (DD**) send the designated message to the Host.

When a Host formatted interim altitude message is sent to the Host, the system shall (DD**) delete the associated Trial Plan, if one exists.

The system shall (DD**) provide the capability to generate a Host-formatted flight plan message.

The system shall (DD**) provide the capability to generate a Host-formatted flight plan amendment message.

The system shall (D**) provide the capability to generate a Host-formatted amendment message from a Current Plan which incorporates a designated ATC Preferred route

3.2.1.1.12 Automated Coordination Processing

Automated Coordination supports non-voice coordination between sector controllers by providing a capability for a controller to coordinate a Trial or Current Plan with another sector position. The sector initiating a coordination request is termed the initiating sector. The sector receiving a coordination request is termed the receiving sector. The sector controlling the aircraft is termed the controlling sector. The Trial Plan or Current Plan that is sent to another sector for coordination is termed the Coordination Plan.

When automated coordination is disabled at a sector, the system shall (DD2855) inhibit receiving Coordination Plans at that position.

When Automated Coordination is disabled at a sector, the system shall (DD4226) provide the user at that sector the capability to initiate a Coordination Plan.

The system shall (DD**) provide the capability to define, in local adaptation, coordination plan reason codes.

3.2.1.1.12.1 Initiating a Coordination Request

CP shall (DD2857) allow a controller to coordinate a Trial Plan with another sector position within the ARTCC by sending a coordination request to that sector position.

CP shall (DD2858) allow only a single Coordination Plan for an aircraft.

The system shall (DD**) provide the user with the capability to coordinate a Current Plan with another sector position within the ARTCC by sending a Coordination Plan to that sector position.

The system shall (DD**) provide the user with the capability to coordinate a Current Plan with another sector position within a neighboring ARTCC by sending a Coordination Plan to that sector position.

CP shall (DD2859) send the Coordination Plan to the sector position controlling the aircraft when the initiating sector position does not control the aircraft of the Plan selected for coordination and the controller did not designate a receiving sector position for the Coordination Plan.

CP shall (DD2860) send a Coordination Plan to a receiving sector position designated by the sector position that initiated the Coordination Plan.

CP shall (DD2861) use an adaptable time for the expiration time of a Coordination Plan.

When a Plan is submitted for Automated Coordination, CP shall (DD2863) remodel the plan and resubmit the plan for probing.

When a Current Plan is being coordinated, the system shall (DD**) provide the capability for the initiating position to coordinate that Current Plan again from the existing Current Plan, if the receiving position responds with Unable or fails to respond within an adaptable time.

The system shall (DD**) remodel the Current Plan and resubmit the Current Plan for probing when a Current Plan is submitted for Coordination.

When a coordination request is sent to a neighboring CP and a Coordination Plan already exists for the aircraft, the neighboring CP shall (DD2864) reject the request.

When a coordination request is initiated and the receiving sector has automated coordination disabled or does not have conflict probe operational, the request shall (DD2865) be rejected with the reason indicated at the initiating sector.

3.2.1.1.12.2 Receiving a Coordination Request

When a Coordination Request is received, a Coordination Plan shall (DD2867) be displayed at the receiving sector.

The receiving position shall (DD2868) be able to respond to the request with Approved/Cleared, Unable, or Send Amendment to send a flight plan amendment to the HCS.

An Approved/Cleared, Send Amendment or Unable response shall (DD2869) be indicated to the initiating sector.

If the receiving position fails to respond within a parameter time, the failure to respond shall (DD2870) be indicated to the initiating sector.

When a Trial Plan is being coordinated, CP shall (DD2871) provide the capability for the initiating position to coordinate that Trial Plan again from the existing Trail Plan, if the receiving position responds with Unable or fails to respond within an adaptable time.

When the initiating sector is in a neighboring CP facility, the responding CP shall (DD2872) send information to the initiating CP to incorporate in the Coordination Plan and display.

When a coordination request is received by a neighboring CP, the neighboring CP shall (DD2873) construct a Coordination Plan using information from the initiating CP.

3.2.1.1.12.3 Updating of Coordination Plan

Results of probing for a Coordination Plan shall (DD2875) be updated when any of the following occur:

a. The trajectory of the subject aircraft in the Coordination Plan has changed
b. The trajectory of an object aircraft has changed so that the conflict has moved in time by greater than a parameter time, or the severity coding for the conflict has changed
c. The trajectory of an object of the Coordination Plan problem has changed such that it is no longer in conflict with the subject of the Coordination Plan
d. The trajectory of another aircraft has changed to create a conflict with the subject of the Coordination Plan

When the trajectory of the subject aircraft in the Coordination Plan has changed, CP shall (DD2876) remodel the plan and resubmit the plan to probing.

3.2.1.1.12.4 Handoff of Aircraft with Coordination Plan

When the initiating sector is the controlling sector and track control of the aircraft is transferred to the receiving sector, the Coordination Plan shall (DD2878) be removed from display at the initiating sector.

The receiving sector (now the controlling sector) shall (DD2879) be able to submit a flight plan amendment based on the Coordination Plan, if such amendments exist for that Coordination Plan.

The receiving sector (now the controlling sector) shall (DD2880) be able to delete the Coordination Plan.

When the receiving sector is the controlling sector and track control of the aircraft is transferred to a sector other than the initiating sector, the received Coordination Plan shall (DD2882) be handed off with the aircraft.

When the receiving sector is the controlling sector and track control of the aircraft is transferred to the initiating sector, the Coordination Plan shall (DD2883) be removed from display at the receiving sector.

3.2.1.1.12.5 Deletion of Coordination Plan

A Coordination Plan shall (DD2885) be deleted when:

a. The Flight Plan is deleted.

b. The initiating position cancels the Coordination Plan or the initiating position deletes the Coordination Plan after a response has been received.

c. The initiating or receiving position sends an amendment based on the Coordination Plan to the HCS.

d. The initiating sector is the controlling sector and the aircraft hands off to a sector other than the receiving sector.

e. The Coordination Plan expires at the initiating sector.

When the initiating position cancels a Coordination Request to a neighboring CP facility, CP shall (DD2886) send information to the neighboring CP to cancel the Coordination.

3.2.1.1.13 Host Data Processing

CP receives flight data and track data from the local Host and uses this data to generate trajectories and maintain CP displays. It will also receive other data from the Host to keep the Host and CP in synchronization following ATC configuration changes and CP startup/restart. CP will send flight plan amendments generated from Trial Plans to the Host. The data exchanged between Host and CP is defined in the Host/ATM IRD.

CP shall (DD2889) process the following messages from the Host:

a. Flight Plans (FH)
b. Supplemental Flight Plan Data (HF)
c. Flight Amendment (AH)
d. Interim Altitude (LH)
e. Aircraft Identification Amend (IH)
f. Departure Information (DH)
g. Cancellation (CH)
h. Track Data (TH)
i. Drop Track (RH)
j. Progress Report (PH)
k. Sector Assignment Status (SH)
l. Adapted Arrival/Departure Route Status (HR)
m. Interim Altitude Status (HE)
n. Training Sector-FPA Assignment (TF)
o. Unsuccessful Transmission Message

3.2.1.1.14 Interfacility Processing

The purpose of CP interfacility functionality is to make trajectory modeling and conflict detection as accurate within a parameter distance outside of a facility's boundary as it is within the facility. The nominal value used for this distance is 200 nautical miles for capacity planning and interfaces. This area surrounding the facility is called the Automated Problem Detection (APD) boundary. The APD boundary is sized to effectively provide an accurate conflict detection up to 20 minutes into the future beyond facility boundaries. The facilities that overlap the APD boundary are referred to as neighboring facilities. These may be more than just the adjacent facilities.

CPs in neighboring facilities will exchange flight data, position and reconformance data, and status information in order to model accurate trajectories for all flights within the APD boundary. Each CP will maintain adaptation data which affects the creation of trajectories and determination of problems within a larger region referred to as the Planning Region.

This means having adaptation data for all neighboring facilities and exchanging configuration data dynamically with neighboring facilities such as preferential routes and restrictions changes.

Each CP shall (DD2894) be capable of communicating with neighboring CPs within that facility's APD boundary.

Each CP shall (DD2895) use its own adaptation data and the adaptation from its neighboring facilities that are needed for interfacility processing.

When applying preferential routes and restrictions of a neighboring facility, the current status of the route or restriction in the neighboring facility shall (DD2896) be used.

The flight owner shall (DD4266) send an Interfacility Current Plan to an affected CP an adapted time prior to the flight entering the APD boundary of the affected CP.

The flight owner shall (DD2897) send flight information necessary for maintaining trajectory modeling and problem detection to all affected systems whenever the category status is defined as Category A or B. This includes any changes in the flight plan data, reconformance data, controlling sector, and flight status. CPs that have knowledge of a flight through interfacility communication with another CP are referred to as affected CPs.

The system shall (DD**) send necessary trajectory modeling and conflict detection flight information for a flight to all affected CPs whenever the Flight Category for that flight is F and an Interfacility Current Plan for that flight does not exist. This includes any changes in the flight plan data for that aircraft.

When the owning facility's CP has an outbound flight that downgrades to a Category G, CP shall (DD2898) send messages to delete the interfacility Current Plan from all affected CPs. The Current Plan will remain in the owning facility's CP until one of the Flight Plan deletion criteria is met as described in Flight Plan Processing.

The owning facility's CP shall (DD2899) send messages to delete the interfacility Current Plan in all affected CPs when the Current Plan is deleted in the owning CP.

The owning facility's CP shall (DD2900) send a message to delete the interfacility Current Plan in an affected CP when the flight has exited the APD boundary of the affected facility.

Even when the Current Plan for a flight is constructed from a flight plan received interfacility, CP shall(DD2901) display the flight data on the Aircraft List from the co-located HCS flight plan, if available.

If the flight plan has not yet been received from the co-located HCS, CP shall (DD2902) display the flight data from the interfacility Flight Plan.

3.2.1.1.15 Weather Data Processing

The NWS will compute binary gridded meteorological data, which is generated by the Mesoscale Analysis and Prediction System (MAPS). This data is coded and distributed in the "FM92-VIII Ext. GRIB (Gridded Binary)" format defined by the World Meteorological Organization Commission for Basic Systems.

CP shall (DD2905) specifically accept the National Meteorological Center Rapid Update Cycle (RUC) upper air model data.

CP shall (DD2906) obtain from its Weather Interface an adaptation-defined number of hours of the most recent RUC data that has been geographically filtered based on adaptation defined site boundary information.

Upon data transfer completion, CP shall (DD2907) extract from each RUC file the wind vector components, temperature, and pressure information it bears.

In the event that weather updates are not received after an adaptable period of time, CP shall (DD2908) display an indication that weather updates are not being received.

3.2.1.1.16 Health Monitoring and Recovery

3.2.1.1.16.1 Recovery of Conflict Probe Displays

CP shall (DD2911) recover conflict probe displays following restoral of the D-position operational display hardware or software. Recovery includes reestablishing display data still available to CP and applicable to the failed position at the time of restoral.

3.2.1.1.16.2 Start-Up, Restart, and Neighboring Facility Unavailable

When CP cannot establish interfacility communications with a remote CP, it shall (DD2913) try to establish communication with that remote system at parameter intervals.

At system start-up, CP shall (DD2914)(DD625) be capable of receiving and processing from the HCS all stored Flight Plans, the current sectorization of the facility, the active and inactive status of preferential routes, and interim altitudes (via Interim Altitude Status (HE) message) associated with all flights.

When the initializing CP receives data from all its neighbors that are operational and finishes processing the start-up data, it enters normal, steady-state processing.

When a neighboring CP starts up and communication is established with the neighboring CP, CP shall (DD2917) send the initializing CP start-up data necessary to establish the initializing CP. This data will include route status, restriction status, and data related to Current Plans owned by that neighbor CP that are within the APD boundary.

Normal operations will accommodate dynamic changes as neighboring CPs follow scheduled periods of downtime or experience failures. CP shall (DD2918) detect interfacility communication and neighboring CP failures.

When a neighboring CP is unavailable and a Flight Plan is received from the collocated Host for flights inbound to the CP facility from that neighboring CP facility, CP shall (DD2919) model the flight plan according to the Flight Plan received from the collocated Host . The Flight Plan is not communicated interfacility until control of the flight is accepted in the inbound facility.

When a neighboring CP is unavailable and a flight is handed-off and leaves the facility airspace outbound from a CP facility to that neighboring CP facility, CP shall (DD2920) model the flight plan according to the Flight Plan received from the collocated Host. The CP facility will send messages to delete the associated interfacility Current Plan from all affected CPs.

When a neighboring CP becomes unavailable, flights inbound or outbound from the affected facility, modeled from the failed facility's Current Plan, shall (DD2921) be remodeled with the affected facility's HCS Flight Plan, if available, or deleted if no HCS Flight Plan is available.

When current Plans are again received from a previously unavailable neighboring CP, the affected CP shall (DD2922) revert to modeling the interfacility Current Plan and maintaining the HCS Flight Plan in the background.

When a CP detects that the collocated Host is unavailable for longer than a parameter time, the CP shall (DD2923) notify the users and report the outage to neighboring facilities with which it establishes communication. The neighboring CPs will treat this outage as if the CP itself is unavailable.

3.2.1.1.17 Route Highlighting Processing

The Host Computer System currently prints certain information in the route field of the flight strips in red to highlight to the controller that an action is to be taken. The highlighting is used to indicate that preferential routes have been applied by the Host, that there are changes embedded in the route, or that the route could not be completely processed by the Host. An analogous capability is provided in CP. This section defines the processing requirements that support the display requirements.

CP shall (DD2926) parse the route field in Host flight plan messages to identify the portion of the route field to be highlighted and the type of highlighting that applies. CP shall (DD2927) be able to process one PDR, one PAR or incomplete route indicator, and one embedded route string within a single flight plan route.

CP will determine at which sector the highlighting is to be displayed as follows:

a. For PAR highlighting, the posting sector shall (DD2929) be determined from the FPA containing the first PAR fix in the Supplemental Flight Plan Data (HF) message from the HCS. If the posting sector is not a sector that the trajectory is predicted to penetrate (i.e. predicted descent occurs prior to the transition fix or A-line point of intersection), then the sector that is predicted along the trajectory at the transition fix or A-line point of intersection (Predicted Sector) shall (DD2930) be treated as a

downstream sector from the posting sector and CP shall (DD2931) post to the posting sector at the same time as it would post to the Predicted Sector (at the transition fix or A-line point of intersection).

b. For PDR and PDAR highlighting, the posting FPA shall (DD2932) be determined from the FPA containing the first postable fix in the Supplemental Flight Plan Data (HF) message from the HCS.

c. For embedded route string changes, the highlighting shall (DD2933) be presented to the first en route sector in the facility that the flight enters.

d. For incomplete route highlighting, the highlighting shall (DD4152) be presented at every sector at which the flight is displayed.

For PAR, PDR, and PDAR highlighting, ICP shall (DD2935) provide for display the PDR/PDAR Alphanumerics and the PAR Alphanumerics in the Supplemental Flight Plan Data (HF) message from the HCS.

CP shall (DD2936) inhibit route truncation for any portion of the route string that is being highlighted in accordance with these requirements.

3.2.1.1.18 Adaptability

CP shall (DD4107) be adaptable to accommodate changes to the following:

a. Airspace definition: adapted routes, including preferential routes, fixes, restrictions, planning region airspaces, tactical airspace boundaries, Automated Problem Detection Inhibited Area (APDIA) boundaries, planning region boundary, FPA boundaries

b. Aircraft characteristics (DD4108)

c. Error distributions related to future position predictions (DD4109)

d. Number of hours of RUC data maintained and the boundary of weather data to request (DD4110)

e. Distance to transition to a received altitude from HCS while in cruise or arrival phase of flight (DD4111)

f. Maximum number of unreasonable or missing track points in a parameter number of received track reports (DD4112)

g. Number of track reports retained in track history (DD4113)

h. Maximum distance from filed route for a flight to be considered "far away from route" (DD4114)

i. Adapted characters in assigned altitude of a flight for a flight to be inhibited from APD eligibility (DD4115)

j. Number of out of conformance position reports for a flight to be declared out of conformance in a dimension (DD4116)

k. Basic conformance criteria (DD4117

l. Volumes of airspace with values to be used for altering the basic conformance bounds (DD4118)

m. Volumes of airspace and separation standards for use in the volume (DD4119)

n. Parameter increase in separation used in APD for a flight that contains more than one aircraft (DD4120)

o. Parameter time past the first maneuver start point for using different separation criteria when checking a Trial Plan (DD4121)

p. Parameters for conversion of likelihood of aircraft-to-aircraft Current Plan conflicts to warning time (DD4170)

q. Parameter horizontal miss distance and conflict duration for determining when a Trial Plan alert is inhibited (DD4122)

r. Parameter time used to determine whether conflict notification should be inhibited based on time of horizontal point of closest approach (DD4123)

s. Parameter for determining that "immediate conflicts" should be inhibited (DD4124)

t. Set of destination airports and set of sectors for inhibiting conflict notification (DD4125)

u. Parameter time in the future for checking Trial Plans for aircraft-to-aircraft conflicts (DD4126)

v. Parameter time in advance for notification of aircraft-to-airspace conflicts (DD4127)

w. Parameter time from current time for determining a maneuver start point in trial planning (DD4128)

x. Parameter time used to determine when a conflict has changed due to change in a Current Plan trajectory of an object of the Trial Plan so that the problem displayed for a Trial Plan is invalid (DD4129)

y. Parameter time for determining when to include speed and altitude changes that start in the future in a Host Amendment message (DD4132)

z. Expiration time for a Coordination Plan (DD4133)

aa. Time to respond to a coordination request (DD4134)

bb. APD boundaries of neighboring facilities (DD4135)

cc. Parameter time to attempt to re-attempt to establish interfacility communications (DD4136)

dd. Time the Host is unavailable before notifying users (DD4137)

ee. Parameter time delay for deleting flight data (DD4138)

ff. Parameter distance outside boundary for deleting flight data (DD4139)

gg. Parameter time for deleting flight data for a proposed flight (DD4140)

hh. Parameter time for deleting a Trial Plan (DD4141)

ii. Distance over which an aircraft in climb is modeled as level at an interim altitude

jj. Enable route display truncation

kk. Number of route elements required for route display truncation to be applied

ll. If truncate displayed route, number of fixes beyond facility boundary at which truncation occurs

mm. Time prior to crossing APD boundary of a neighboring facility that an Interfacility Current Plan is sent to the neighbor, and

nn. Definition of Arrival Stream Filters.

3.2.1.1.19 Data Recording

CP shall (DD2940) record data needed for analysis and fine tuning of algorithms, including those used in trajectory modeling, APD, conformance monitoring, reconformance, and trial planning.

CP shall (DD2941) record data needed for resolution of CHI design issues.

CP shall (DD2942) record data needed for study and validation of external data received across system interfaces.

CP shall (DD2943) record system-input data needed for replay into the system to recreate system operation during test and training.

3.2.1.1.20 Conflict Probe Computer Human Interface

This section includes requirements for the conflict probe displays and associated user inputs.

3.2.1.1.20.1 General Capabilities for CP Windows

The system shall (DD2947) be capable of providing, at a minimum, the following types of coding (discrimination) for CP display data:

a. Color coding
b. Brightness Coding
c. Reverse Video Coding
d. Box Coding (for example, draw a box around a display item)
e. Line Width Coding.

When a new air space configuration is assigned to the sector position, the system shall (DD2948) update the CP windows at the controller position to contain data for the new assigned air space configuration.

Whenever changes are made to the contents of a CP window at a D-position, the system shall (DD2949) update the corresponding contents of each CP window containing those data to reflect the changes within that D-position.

The system shall (DD**) permit display manipulation and controller inputs while response to that position's previous request for automated coordination or trial planning is pending.

The system shall (DD**) receive and display system responses and messages while response to that position's previous request for automated coordination or trial planning is pending.

3.2.1.1.20.2 CP Interactions

The system shall (DD2951) provide the capability for the user to compose and enter CP commands via the following input devices:

a. Cursor positioning selection device (CPSD)

b. Display System (DS) keyboard.

CP will provide feedback in response to user input.

Manually entered data will be displayed (i.e., echoed) for user confirmation prior to system acceptance and processing.

3.2.1.1.20.3 CP System Status Display

The CP System Status display will provide the status for the local CP and the neighboring facilities CPs.

CP system status shall (DD2954) be available for display at each D-position containing the following:

a. Status of local CP

b. Status of neighboring facility CPs

c. CP active/inactive for that D-position

d. Auto Coordination active/inactive for that D-position

e. Host data availability.

In addition to the CP System Status information displayed at each D-position the following CP System Status information shall (DD4227) be displayed at adapted D-positions:

a. Winds and temperature data available status and time of last update

b. CP active/inactive for each local D-position

c. Auto Coordination active/inactive for each local D-position.

The system shall (DD2955) provide a visual indication if the CP system status changes.

3.2.1.1.20.4 Aircraft List

The Aircraft List will display flight plan data and alert status for aircraft.

The Aircraft List will also provide an interface for trial planning and for accessing plan information, accessing the Graphic Plan Display, converting speeds and activating/deactivating altitude restrictions.

3.2.1.1.20.4.1 Aircraft List - Data

The system shall (DD2959) be capable of displaying the following data in the Aircraft List:

a. Number of aircraft in the Aircraft List

b. Aircraft ID/Computer ID (CID) Entry Field

c. Sort Order Label.

d. List of centers with interfacility communications available.

The system shall (DD2960) provide an indication to the user that the Aircraft List window is not large enough to display all Aircraft List entries.

The system shall (DD2961) be capable of displaying the following data for each list entry in the Aircraft List:

a. Bookkeeping Box to record check marks
b. Alert Indicators as follows:
    1) Number of alerts of each type assigned to the sector
    2) For aircraft with one or more alerts of any kind assigned to the sector, an indication of aircraft-to-aircraft alerts (for each type) assigned to other sectors
    3) An indication of aircraft-to-airspace alerts assigned to other sectors.
c. Coordination Request Indicator
d. CID
e. Aircraft ID
f. Aircraft control designator
g. Assigned altitude, interim altitude, blocked altitude, or VFR indicator
h. Remarks indicator
i. Aircraft type, equipage, number of aircraft, and Heavy/TCAS Indicator
j. Route
k. Beacon code

The term "aircraft control designator" is used in this document to mean the number of the controlling sector for aircraft controlled within the facility, the name of the controlling center and the number of the controlling sector for aircraft controlled outside the facility, or the "unknown" designator, if the controlling center or sector is unknown.

When route truncations is enabled, the route displayed in the Aircraft List for flights that exit the facility shall (DD2962) be truncated following an adapted number of fixes after exiting the facility and be replaced with a truncation indicator unless the destination is within an adaptable number of route elements of the ARTCC boundary.

When route truncation is disabled, the system shall (DD4271) display a route in the Aircraft List without truncation.

The route field displayed in the Aircraft List shall (DD2963) include the destination field.

For PDR, PDAR, and PAR routes at the highlighting display sector position, the system shall (DD2964) display both preferential route alphanumeric and the filed route.

The system shall (DD2965) display the preferential route alphanumeric at the downstream sectors as embedded text in the route.

The system shall (DD**) provide an indication of the posting mode within the Aircraft List.

When a supplemental flight plan information message is received from the Host indicating an unsuccessful transmission condition the system shall (DD**) display the facility identifier that was unable to receive the transmission as identified in that message.

3.2.1.1.20.4.2 Aircraft List - Posting, Updating, Deleting

Aircraft will be posted to the Aircraft List under the following conditions:

a. An aircraft shall (DD2968) be posted to the Aircraft List when the aircraft has departed and is predicted to cross the boundary into the

sector within an adapted time for an aircraft not currently posted on the Aircraft List.

b. An aircraft shall (DD2969) be posted to the Aircraft List when the system detects an inbound hand-off (from a track message) into the sector for an aircraft not currently posted on the Aircraft List.

c. An aircraft shall (DD2970) be posted to the Aircraft List when an alert detected by APD is assigned to the sector and at least one aircraft involved in the alert is not currently posted on the Aircraft List.

d. An aircraft shall (DD2971) be posted to the Aircraft List when a coordination request is received at a sector for an aircraft and that aircraft is not currently posted on the Aircraft List.

e. An aircraft shall (DD**) be posted to the Aircraft List if a supplemental flight plan information message is received from the Host indicating an unsuccessful transmission condition for that aircraft and there is no associated entry on the Aircraft List for that aircraft.

Flights shall (DD**) be posted on the Aircraft List for the sector position controlling the FPA containing the first PAR fix as indicated by the Host.

The Aircraft List data shall (DD2975) be updated when any of the displayed information changes.

Aircraft List entries shall (DD2976) be coded for removal, and removed after an adapted time unless otherwise specified by the user for any of the following conditions:

a. The system detects an outbound handoff for an aircraft that is not currently involved in an aircraft-to-aircraft alert assigned to the sector and does not have a received Coordination Request

b. A predicted sector penetration is no longer predicted to occur and the aircraft is not involved in an aircraft-to-aircraft conflict assigned to the sector, and does not have a received Coordination Request.

Aircraft List entries for a flight shall (DD4236) be coded for removal, and removed after an adaptable time when the flight plan has been deleted by the system.

3.2.1.1.20.4.3 Aircraft List - Sorting

The Aircraft List shall (DD2978) have a default sort order.

When either the user or the system sets the posting mode to automatic, the system shall (DD**) position all entries currently in the Aircraft List, except for those designated for special attention, based on the current sort criteria.

When the posting mode is set to automatic, new entries added (posted) to the Aircraft List either by the system or manually by the user, shall (DD**) be positioned in the Aircraft List based on the current sort criteria.

When the posting mode is set to manual, new entries added (posted) to the Aircraft List either by the system or manually by the user shall (DD**) be posted at the bottom (manual posting area) of the Aircraft List in the order in which they are received.

In automatic posting mode, when an Aircraft List entry, except for those designated for special attention, is updated such that the sort key data changes, the updated entry shall (DD**) be positioned in the list based on the current sort criteria.

In manual posting mode, when an Aircraft List entry in the manual posting area at the bottom of the list is updated such that the sort key data changes, the updated entry shall (DD**) remain in its current position.

In manual posting mode, when an Aircraft List entry, that is not in the manual posting area at the bottom of the list or that is not designated for special attention, is updated such that the sort key data changes, the updated entry shall (DD**) be positioned in the list based on the current sort criteria.

When an Aircraft List entry that is designated for special attention is updated, such that the sort key data changes, the updated entry shall (DD**) remain in its current position.

3.2.1.1.20.4.4 Aircraft List - Coding

Coding shall (DD2982) be applied to the Aircraft List entries for an adaptable time period prior to automatic removal.

Coding to indicate alert type shall (DD2983) be applied to the alert indicators in the Aircraft List entries.

Coding shall (DD2984) be applied to the Aircraft List entries that are not being probed by APD.

Coding shall (DD2985) be applied to distinguish entries for category B aircraft.

Coding shall (DD2986) be applied to distinguish entries for category F inbound flights without CP interfacility flight plans.

Coding shall (DD29**) be applied to distinguish an Aircraft List entry for a category F flight with a CP interfacility flight plan based on the flight category received.

Coding to indicate alert status shall (DD2987) be applied to the Coordination Request Indicator.

Coding shall (DD2988) be used to distinguish those aircraft to aircraft alerts that occur on a portion of the route that contains a planned or predicted vertical transition that has not been cleared from those alerts that occur on a portion of the route that reflects the aircraft's current clearance.

Coding shall (DD2989) indicate flights for which a preferential route has been inserted into the flight plan. Coding shall (DD2990) indicate flights for which an embedded route has been inserted into the flight plan. Coding shall (DD2991) indicate flights for which a Host-detected or CP detected incomplete route error indicator has been inserted into the flight plan. Coding shall (DD2992) be applied to new entries that have been added to the aircraft list automatically by the system or by a user action.

The system shall (DD**) provide an indication to the user on the Aircraft List when a Planned Holding Area exists for an aircraft.

Coding shall (D**) be applied to an Aircraft List entry for an APR-eligible aircraft when the entry is posted at the first predicted sector within the facility.

Subsequent to the first sector within the facility where an Aircraft List entry is posted, coding shall (D**) be applied to an Aircraft List entry at the controlling sector position for an aircraft that is APR eligible.

Coding of an Aircraft List entry for an APR eligible aircraft shall (D**) be removed when the flight is no longer controlled by the sector position.

Coding shall (D**) be applied to an Aircraft List entry for an APR-eligible aircraft when the entry is posted at the first predicted sector within the facility.

Subsequent to the first sector within the facility where an Aircraft List entry is posted, coding shall (D**) be applied to an Aircraft List entry at the controlling sector position for an aircraft that is APR eligible.

Coding of an Aircraft List entry for an APR eligible aircraft shall (D**) be removed when the flight plan is updated with the ATC Preferred Route.

Coding of an Aircraft List entry for an APR eligible aircraft shall (D**) be removed when the flight is no longer controlled by the sector position.

When a Wrong Altitude for Direction condition is detected for an aircraft, the system shall (DD**) display an indication at the exiting sector position associated with the condition when the condition is detected or when the aircraft is posted on the Aircraft List; whichever is later.

The system shall (DD**) provide the capability, in local adaptation, to define the maximum duration for Aircraft List and Departure List manual posting mode before the posting mode is changed to automatic.

The system shall (DD**) provide the capability, in local adaptation, to define whether entries that have been designated with a visual indication for special attention are positioned at the top of the list in the order selected (most recent selection at the top of the group designated for special attention) or in inverse order (most recent selection at the bottom of the group designated for special attention) for the Aircraft List and the Departure List.

3.2.1.1.20.4.5 Aircraft List - User Functions

3.2.1.1.20.4.5.1 General

The system shall (DD2995) provide the user with the capability to scroll data within the Aircraft List window.

The system shall (DD2996) provide the capability for the user to add an aircraft to the Aircraft List.

The system shall (DD2997) provide the capability for the user to locate aircraft data for a particular flight in the Aircraft List.

The system shall (DD2998) provide the capability for the user to convert a speed to/from True Airspeed, Indicated Airspeed, or Mach speed via the Aircraft List.

The system shall (DD2999) provide the capability for the user to specify the Aircraft List sort order from, at a minimum, the following sort orders:

a. Predicted time at sector boundary
b. Conflict time

c. Conflict status
d. Sector position
e. Aircraft ID
f. Destination

The system shall (DD3000) provide the capability for the user to add a check mark to the Bookkeeping Box in the Aircraft List

The system shall (DD3001) provide the capability for the user to remove the check mark from the Bookkeeping Box in the Aircraft List.

The system shall (DD3002) provide the capability for the user to designate that an Aircraft List entry not be removed by the system.

The system shall (DD3003) provide the capability for the user to delete an aircraft from the Aircraft List provided it has no aircraft-to-aircraft alerts assigned to the sector and has no received Coordination Requests.

The system shall (DD3004) provide the capability for the user to display the Graphics Plan Display via the Aircraft List.

The system shall (DD3005) provide the capability for the user to display the Restrictions Display via the Aircraft List.

The system shall (DD3006) provide a capability for the user to remove the coding that indicates a preferential route was applied.

The system shall (DD3007) provide a capability for the user to remove the coding that indicates an embedded route was applied.

The system shall (DD3008) provide the capability for the controller to remove the "new entry" coding of a single entry in the Aircraft List.

The system shall (DD**) provide the capability for the user to display the Airspace Status Display from the Aircraft List.

The system shall (DD**) provide the capability for the user to specify a visual indication that an Aircraft List entry has been designated for special attention.

The system shall (DD**) provide the capability for the user to remove the visual indication that an Aircraft List entry has been designated for special attention.

When an Aircraft List entry has been designated with a visual indication for special attention, that entry shall (DD**) be positioned at the top of the Aircraft List if no other entries have been designated for special attention .

When multiple Aircraft List entries have been designated with a visual indication for special attention, those entries shall (DD**) be positioned at the top of the Aircraft List in the order selected (most recent selection at the top of the group designated for special attention) or in inverse order (most recent selection at the bottom of the group designated for special attention) based on adaptation.

When the visual indication for special attention has been removed from an Aircraft List entry, the position of that entry in the Aircraft List shall (DD**) return to the position based on the current sort factor that is specified for the Aircraft List.

The system shall (DD**) provide the user with the capability to specify the posting mode for the Aircraft List: automatic vs manual.

The system shall (DD**) provide the capability in adaptation to specify the duration that the Aircraft List can remain in manual mode.

When the duration for manual posting mode specified in adaptation is exceeded, the system shall (DD**) set the posting mode to automatic for the Aircraft List.

The system shall (DD**) provide the capability for the user to apply a Planned Holding Area to an aircraft's Current Plan at the aircraft's present position from the Aircraft List.

The system shall (DD**) provide the capability for the user to apply a Planned Holding Area to an aircraft's Current Plan at a designated fix in the aircraft's Current Plan from the Aircraft List.

The system shall (DD**) provide the capability for the user to apply a Planned Holding Area to an aircraft's Current Plan at a designated future location in the predicted route of flight for an aircraft from the Aircraft List.

The system shall (DD**) provide the capability for the user to terminate a Planned Holding Area for an aircraft's Current Plan from the Aircraft List.

The system shall (D**) provide the capability to submit a Host-formatted flight plan message.

The system shall (D**) provide the capability for the user to construct a trial plan that incorporates an applicable ATC Preferred Route.

The system shall (D**) provide the capability for the user to remove coding of an Aircraft List entry for an APR eligible aircraft.

The system shall (D**) provide the capability for the user to re-apply coding of an Aircraft List entry for an APR eligible aircraft that has been manually removed.

The system shall (DD**) provide the capability for the user to add an indication that manual action is required for an aircraft from the Aircraft List.

The system shall (DD**) provide the capability for the user to remove an indication that manual action is required for an aircraft from the Aircraft List.

The system shall (DD**) provide the capability for the user to enter speed data for a designated Aircraft List entry.

The system shall (DD**) provide the capability for the user to enter heading data for a designated Aircraft List entry.

The system shall (DD**) provide the capability for the user to enter free form text data for a designated Aircraft List entry.

The system shall (DD**) provide the capability for the user to delete speed data from a designated Aircraft List entry.

The system shall (DD**) provide the capability for the user to delete heading data from a designated Aircraft List entry.

The system shall (DD**) provide the capability for the user to delete all of the free form text data from a designated Aircraft List entry.

The system shall (DD**) provide the user with the capability to suppress the display of free-form text data for a designated Aircraft List entry.

The system shall (DD**) provide the user with the capability to re-display suppressed free-form text data for a designated Aircraft List entry.

When free-form text data is suppressed for an Aircraft List Entry, the system shall (DD**) provide an indication in the Aircraft List Entry that free-form-text is suppressed.

The system shall (DD**) provide the capability for the user to send speed, heading, or speed and heading data to a designated sector.

When speed, heading, or speed and heading data are sent to a designated sector, the system shall (DD**) display that speed and/or heading data in the receiving sector's Aircraft List.

3.2.1.1.20.4.5.2 Trial Planning

The system shall (DD3010) provide the capability for the user to create a Trial Plan from the Aircraft List.

The system shall (DD**) provide the capability for the controller to create a Trial Plan from a Current Plan with an adapted restriction removed.

The system shall (DD**) provide the capability for the controller to create a Trial Plan from a Current Plan with an adapted restriction imposed.

3.2.1.1.20.4.5.3 Display Plans on the Graphic Plans Display

3.2.1.1.20.4.5.3.1 Show Alerts Assigned to the Sector for a Flight

The system shall (DD3014) provide the capability for the user to graphically display a Current Plan route, with all associated alerts assigned to the sector, on the Graphic Plan Display for a selected aircraft in the Aircraft List.

The system shall (DD3015) provide the capability for the user to remove the display of a Current Plan route, with all associated alerts assigned to the sector, on the Graphic Plan Display for a selected aircraft in the Aircraft List.

The system shall (DD3016) provide the capability for the user to graphically display a Current Plan route, with all alerts of a specific alert type assigned to the sector, on the Graphic Plan Display for a selected aircraft in the Aircraft List.

The system shall (DD3017) provide the capability for the user to remove the display of a Current Plan route, with all alerts of a specific alert type assigned to the sector, on the Graphic Plan Display for a selected aircraft in the Aircraft List.

3.2.1.1.20.4.5.3.2 Show All Alerts for a Flight

The system shall (DD3019) provide the capability for the user to graphically display a Current Plan or a Coordination Received Plan route, with all associated alerts assigned to the sector, as well as any alerts not assigned to the sector, on the Graphic Plan Display for a selected aircraft in the Aircraft List.

The system shall (DD3020) provide the capability for the user to remove the display of the Current Plan or Coordination Received Plan including all associated alerts assigned to the

sector, as well as any alerts not assigned to the sector on the Graphic Plan Display for a selected aircraft in the Aircraft List.

3.2.1.1.20.4.5.4 Display Plans in Plans Display

The system shall (DD3022) provide the capability for the user to display a Current Plan on the Plans Display for a selected flight in the Aircraft List.

The system shall (DD3023) provide the capability for the user to view a received Coordination Plan on the Plans Display for a selected flight in the Aircraft List.

3.2.1.1.20.4.5.5 Display of Flight Data in Response Display

The system shall (DD3025) provide the capability for the user to display flight data in the Response Display via the Aircraft List.

The system shall (DD3026) provide the capability for the user to remove flight data from the Response Display via the Aircraft List.

The system shall (DD**) provide the capability for the user to display in the Response Display the previous flight plan (prior to the latest Amendment message that modified it) for a flight, by selecting an entry in the Aircraft List.

3.2.1.1.20.5 Departure List

The Departure List will display proposed flight plan data.

The Departure List will also provide an interface for trial planning, for accessing plan information, and for accessing the Graphic Plan Display.

3.2.1.1.20.5.1 Departure List - Data

The system shall (DD**) be capable of displaying the following data in the Departure List:

a. Number of Aircraft in the Departure List
b. Aircraft ID/CID Entry Field
c. Sort Order Label.

The system shall (DD**) provide an indication to the user that the Departure List window is not large enough to display all Departure List entries.

The system shall (DD**) be capable of displaying the following data for each list entry in the Departure List:

a. Bookkeeping Box to record check marks
b. Computer ID
c. Aircraft ID
d. Remarks Indicator
e. Aircraft Type, Equipage, Number of Aircraft, and Heavy/TCAS Indicator
f. Route
g. Beacon Code
h. Proposed departure time

i. Expected Departure Clearance Time (EDCT).

When route truncation is enabled, the route displayed in the Departure List for flights that exit the facility shall (DD**) be truncated following an adapted number of fixes after exiting the facility and be replaced with a truncation indicator unless the destination is within an adaptable number of route elements of the ARTCC boundary.

When route truncation is disabled, the system shall (DD**) display a route in the Departure List without truncation.

The route field displayed in the Departure List shall (DD**) include the destination field.

For PDR, PDAR, and PAR routes at the highlighting posting sector position, the system shall (DD**) display both preferential route alphanumerics and the filed route in the Departure List.

The system shall (DD**) provide an indication of the posting mode within the Departure List.

3.2.1.1.20.5.2 Departure List - Posting, Updating, Deleting

The system will post aircraft to the Departure List under the following conditions:

a. Proposed flights shall (DD**) be posted on the departure list for the en route sector position controlling the FPA containing the first postable fix as indicated by the Host, an adaptable time prior to departure.

b. The Departure List data shall (DD**) be updated when the displayed information changes.

The following are the rules for deletion of entries in the Departure List by the system:

a. Departure List entries for a flight shall (DD**) be coded for removal, and removed after an adaptable time unless otherwise specified by the user, when the system detects that the aircraft has departed.

b. Departure List entries for a flight shall (DD**) be coded for removal, and removed after an adaptable time when the flight plan has been deleted by CP.

3.2.1.1.20.5.3 Departure List - Sorting

The Departure List shall (DD**) have a default sort order.

When either the user or the system sets the posting mode to automatic, the system shall (DD**) position all entries currently in the Departure List, except those designated for special attention, based on the current sort criteria.

When the posting mode is set to automatic, new entries added (posted) to the Departure List either by the system or manually by the user, shall (DD**) be positioned in the Departure List based on the current sort criteria.

When the posting mode is set to manual, new entries added (posted) to the Departure List either by the system or manually by the user shall (DD**) be posted at the bottom (manual posting area) of the Departure List in the order in which they are received.

In automatic posting mode, when a Departure List entry, except for those designated for special attention, is updated such that the sort key data changes, the updated entry shall (DD**) be positioned in the list based on the current sort criteria.

In manual posting mode, when a Departure List entry in the manual posting area at the bottom of the list is updated such that the sort key data changes, the updated entry shall (DD**) remain in its current position.

In manual posting mode, when a Departure List entry, that is not in the manual posting area at the bottom of the list or that is not designated for special attention, is updated such that the sort key data changes, the updated entry shall (DD**) be positioned in the list based on the current sort criteria.

When a Departure List entry that is designated for special attention is updated, such that the sort key data changes, the updated entry shall (DD**) remain in its current position.

3.2.1.1.20.5.4 Departure List - Coding

Coding shall (DD**) be applied to a Departure List entry for an adaptable time period prior to automatic removal.

Coding shall (DD**) be used in the Departure List to indicate flights for which a preferential route has been inserted into the flight plan.

Coding shall (DD**) be used in the Departure List to indicate flights for which an embedded route highlighting has been inserted into the flight plan.

Coding shall (DD**) be used in the Departure List to indicate flights for which a Host-detected or CP detected incomplete route error has been inserted into the flight plan.

Coding shall (DD**) be applied to a new entry that has been added to the Departure List by the system or by a user action.

When a Wrong Altitude for Direction condition is detected for an aircraft, the system shall (DD**) display an indication at the exiting sector position associated with the condition when the condition is detected or when the aircraft is posted on the Departure List; whichever is later

3.2.1.1.20.5.5 Departure List - User Functions

3.2.1.1.20.5.5.1 General

The system shall (DD**) provide the user with the capability to scroll data within the Departure List window.

The system shall (DD**) provide the capability for the user to add an aircraft to the Departure List.

The system shall (DD**) provide the capability for the user to locate aircraft data for a particular flight in the Departure List.

The system shall (DD**) provide the capability for the user to specify the Departure List order from, at a minimum, the following sort orders:

a. Proposed Departure Time
b. Origin
c. Aircraft ID
d. Destination

The system shall (DD**) provide the capability for the user to add a check mark to the Bookkeeping Box in the Departure List.

The system shall (DD**) provide the capability for the user to remove the check mark from the Bookkeeping Box in the Departure List.

The system shall (DD**) provide the capability for the user to designate that a Departure List Entry, not be removed by the system.

The user will not be allowed to override the deletion of a Departure List entry when the flight plan is being deleted from the system.

The system shall (DD**) provide the capability for the user to delete an aircraft from the Departure List. When the user deletes an aircraft from the Departure List, the entry is not coded for removal.

The system shall (DD**) provide the capability for the user to display the Graphic Plan Display from the Departure List.

The system shall (DD**) provide a capability for the user to remove the coding that indicates a preferential route was applied for an entry in the Departure List.

The system shall (DD**) provide a capability for the user to remove the coding that indicates an embedded route highlighting was applied for an entry in the Departure List.

The system shall (DD**) provide the capability for the controller to remove the "new entry" coding of a single entry on the Departure List.

The system shall (DD**) provide the capability for the user to specify a visual indication that a Departure List entry has been designated for special attention.

The system shall (DD**) provide the capability for the user to remove the visual indication that a Departure List entry has been designated for special attention.

When a Departure List entry has been designated with a visual indication for special attention, that entry shall (DD**) be positioned at the top of the Departure List if no other entries have been designated for special attention .

When multiple Departure List entries have been designated with a visual indication for special attention, those entries shall (DD**) be positioned at the top of the Departure List in the order selected (most recent selection at the top of the group designated for special attention) or in inverse order (most recent selection at the bottom of the group designated for special attention) based on adaptation.

When the visual indication for special attention has been removed from a Departure List entry, the position of that entry in the Departure List shall (DD**) return to the position based on the current sort factor that is specified for the Departure List.

The system shall (DD**) provide the user with the capability to specify the posting mode for the Departure List: automatic vs manual.

The system shall (DD**) provide the capability in adaptation to specify the duration that the Departure List can remain in manual mode.

When the duration for manual posting mode specified in adaptation is exceeded, the system shall (DD**) set the posting mode to automatic for the Departure List.

The system shall (DD**) provide the capability to submit a Host-formatted flight plan message.

The system shall (DD**) provide the capability for the user to add an indication that manual action is required for an aircraft from the Departure List.

The system shall (DD**) provide the capability for the user to remove an indication that manual action is required for an aircraft from the Departure List.

The system shall (CC**) use the current time in lieu of the proposed departure time when creating the Trial Plan.

The system shall (DD**) provide the capability for the user to trial plan a new proposed departure time for a proposed flight. When no new proposed departure time is entered, the system shall (DD**) use the current time in lieu of the proposed departure time when creating the trial plan.

The system shall (DD**) provide the capability for the user to enter free form text data for a designated Departure List entry.

The system shall (DD**) provide the capability for the user to delete all of the free form text data from a designated Departure List entry.

The system shall (DD**) provide the user with the capability to suppress the display of free-form text data for a designated Departure List entry.

The system shall (DD**) provide the user with the capability to re-display suppressed free-form text data for a designated Departure List entry.

When free-form text data is suppressed for a Departure List Entry, the system shall (DD**) provide an indication in the Aircraft List Entry that free-form-text is suppressed.

The system shall (DD**) provide the user with the capability to suppress the display of free-form text data for a designated Departure List entry.

The system shall (DD**) provide the user with the capability to re-display suppressed free-form text data for a designated Departure List entry.

When free-form text data is suppressed for a Departure List Entry, the system shall (DD**) provide an indication in the Aircraft List Entry that free-form-text is suppressed.

3.2.1.1.20.5.5.2 Trial Planning

The system shall (DD**) provide the capability for the user to create a Trial Plan from the Departure List.

3.2.1.1.20.5.5.3 Display Plans on the Graphic Plan Display

3.2.1.1.20.5.5.3.1 Show All Alerts for an Entry

The system shall (DD**) provide the capability for the user to graphically display the route and all conflicts on the Graphic Plan Display for a selected entry in the Departure List.

The system shall (DD**) provide the capability for the user to remove the display of the route and all conflicts on the Graphic Plan Display for a selected entry in the Departure List.

3.2.1.1.20.5.5.4 Display of Flight Data in Response Display

The system shall (DD**) provide the capability for the user to display flight data in the Response Display by selecting an entry in the Departure List.

The system shall (DD**) provide the capability for the user to remove flight data from the Response Display by selecting an entry in the Departure List.

3.2.1.1.20.6 Plans Display

The Plans Display will display Current Plans, Trial Plans, Replan Trial Plans, and Coordination Plans.

The system shall (DD3029) provide an indication to the user when the Plans Display window is not large enough to display all plans.

3.2.1.1.20.6.1 Plans Display - Data

The system shall (DD3031) be capable of displaying the following data for a Current Plan:

a. Computer ID
b. Aircraft ID
c. Aircraft Control Designator
d. Assigned altitude, interim altitude, blocked altitude, or VFR indicator
e. Requested altitude, for proposed flights only.
f. Route
g. Alert notification, consisting of
    1) Aircraft ID for involved aircraft
    2) Aircraft Control Designator for involved aircraft
    3) Time of violation
    4) Point of Violation Designator
h. Airspace Notification, consisting of:
    1) Airspace name
    2) Time of violation
    3) Point of violation designator
i. Preferred Route Application Notification
j. Removed/imposed restriction for the flight

For PDR, PDAR, and PAR routes at the highlighting display sector, CP shall (DD3032) display both preferential route alphanumerics and the filed route.

The system shall (DD3033) display the preferential route alphanumeric at the downstream sectors as embedded text in the route.

The system shall (DD3034) be capable of displaying the following data for a Trial Plan:

a. Model for General Aviation aircraft
b. Plan ID (Aircraft ID plus Trial Plan designation)

c. Aircraft Control Designator
d. Maneuver Description
e. Time to Trial Plan expiration countdown clock
f. Alert Notification, consisting of:
    1) Aircraft ID for involved aircraft
    2) Aircraft Control Designator for involved aircraft
    3) Time of violation
    4) Point of Violation Designator
g. Airspace Notification, consisting of:
    1) Airspace name
    2) Time of violation
    3) Point of violation designator
h. Preferential Route Application Notification
i. Amendment Message text
j. Removed/imposed restriction for the plan

The system shall (DD3035) be capable of displaying the following data for a Replan Trial Plan:

a. Model for General Aviation aircraft
b. Plan ID (Aircraft ID plus Replan Trial Plan designation)
c. Aircraft Control Designator
d. Maneuver Description
e. Alert Notification, consisting of:
    1) Aircraft ID for involved aircraft
    2) Aircraft Control Designator for involved aircraft
    3) Time of violation
    4) Point of Violation Designator
f. Airspace Notification, consisting of:
    1) Airspace name
    2) Time of violation
    3) Point of violation designator
g. Preferential Route Application Notification
h. Amendment Message text
i. Explanation of termination.
j. Removed/imposed restriction for the plan

The system shall (DD3036) be capable of displaying the following data for a Coordination Plan:

a. Model for General Aviation aircraft
b. Plan ID (Aircraft ID plus Coordination Plan designation)

c. Message area displaying either response from receiver, notification of no response, notification of request cancellation, notification of aircraft deletion, or notification of aircraft handoff.
d. Aircraft control designator
e. Coordination Initiated or Coordination Received Message, indicating other sector
f. Reason code selected by the initiating sector position
g. Maneuver description
h. Time to Coordination Plan expiration countdown clock
i. Alert notification, consisting of:
    1) Aircraft ID for involved aircraft
    2) Aircraft Control Designator for involved aircraft
    3) Time of violation
    4) Point of violation designator
j. Airspace notification, consisting of:
    1) Airspace name
    2) Time of violation
    3) Point of violation designator
k. Preferential route application notification
l. Amendment Message text.
m. Removed/imposed restriction for the plan

The term "point of violation designator" is used in this document to mean the number of the sector containing the point of violation for points of violation within the facility, the name of the center and number of the sector containing the point of violation for points of violation outside the facility, or the "unknown" designator, if the center of sector containing the point of violation is unknown.

3.2.1.1.20.6.2 Plans Display - Posting, Updating, Deleting

Current Plans shall (DD3040) be posted on the Plans Display when requested by the user.

The system shall (DD3041) post a Coordination Plan to the Plans Display when it is received.

When a Trial Plan (including replans) or initiated Coordination Plan is created the system shall (DD3042) post it to the Plans Display.

Entries in the Plans Display shall (DD3043) be updated by the system whenever there are changes in the displayed data.

Entries in the Plans Display shall (DD3044) be coded for removal and removed by the system after an adapted time, or removed upon manual request by the user.

3.2.1.1.20.6.3 Plans Display - Sorting

Entries on the Plans Display shall (DD3046) be sorted by type of plan.

Within each type of plan, entries shall (DD3047) be sorted by the default sort order for that plan type.

3.2.1.1.20.6.4 Plans Display - Coding

An entry shall (DD3049) be coded to indicate pending removal.

Alert coding, when applied, shall (DD3050):

a. indicate that the predicted lost separation is less than procedural requirements
b. indicate that the predicted lost separation is greater than or equal to procedural requirements but within the detection threshold
c. indicate the loss of separation with Special Activities Airspace.

A Trial Plan ID shall (DD3051) be coded to indicate the Trial Plan is problem free or to indicate the most severe alert associated with the Plan.

A Trial Plan shall (DD3052) be coded to indicate that it is invalid when the system detects a Current Plan change that affects the Trial Plan's APD results.

Alert coding shall (DD3053) be applied to Trial Plans.

A Replan Trial Plan ID shall (DD3054) be coded to indicate the Replan Trial Plan is problem free or to indicate the most severe alert associated with the plan.

Alert coding shall (DD3055) be applied to Replan Trial Plans.

A Replan Trial Plan shall (DD3056) be coded:

a. for an adaptable period of time to indicate that new alert information has been posted
b. for an adaptable period of time to indicate the severity of the alert has changed
c. for an adaptable period of time to indicate the Point of Violation sector has changed
d. for an adaptable period of time when APD determines the problem no longer exists.

A Coordination Message Area shall (DD3057) be coded to indicate:

a. that the flight plan is deleted
b. that the initiating sector has canceled the coordination, and
c. that the user can take action on the Coordination Plan
d. approval
e. a cleared status
f. an Amendment has been sent to the Host
g. the receiving sector did not respond or responded Unable
h. the receiving sector does not support Automated Coordination
i. handoff.

A Coordination Plan ID shall (DD3058) be coded to indicate the Coordination Plan is problem free or to indicate the most severe alert associated with the Plan.

Alert coding shall (DD3059) be applied to Coordination Plans.

A Coordination Plan shall (DD3060) be coded:

a. for an adaptable period of time to indicate that new alert information has been posted

b. for an adaptable period of time to indicate the severity of the alert has changed

c. for an adaptable period of time to indicate the Point of Violation sector has changed

d. for an adaptable period of time when a conflict involving that Coordination Plan no longer exists.

A Current Plan ID shall (DD3061) be coded to indicate that no problems for the Plan have been assigned to the sector or to indicate the most severe alert associated with the Plan and assigned to the sector.

Alert coding shall (DD3062) be applied to Current Plans.

Alert coding for Current Plans shall (DD3063) distinguish those aircraft-to-aircraft alerts that occur on a portion of the Current Plan's route that contains a vertical transition that has not been cleared, from those alerts that occur on a portion of the route that reflects the aircraft's current clearance.

A Current Plan shall (DD3064) be coded:

a. For an adaptable period of time to indicate that new alert information has been posted

b. For an adaptable period of time to indicate the severity of the alert has changed

c. For an adaptable period of time to indicate the Point of Violation sector has changed

d. For an adaptable period of time when APD determines the problem no longer exists

e. To indicate that the Plan is not being probed by APD.

When a Wrong Altitude for Direction condition is detected for an aircraft, the system shall (DD**) display an indication at the exiting sector position associated with the condition when the condition is detected or when the aircraft is posted on the Plans Display; whichever is later.

3.2.1.1.20.6.5 Plans Display - Exceptions

When the Plans Display is either covered by another window or is not displayed, the system shall (DD3067) force its display on top of all other displayed windows, except the Time Display, whenever any of the following occur:

a. The user requests display of an item on the Plans Display

b. The user creates a Trial Plan via the Aircraft List.

When the Plans Display is minimized or removed, the system shall (DD4237) update the Plans Display and notify the user whenever any of the following occur:

a. A response to an Automated Coordination request is received

b. A Coordination Plan is received.

The system shall (DD3068) remove the Plans Display when it contains no entries.

3.2.1.1.20.6.6 Plans Display - User Functions

3.2.1.1.20.6.6.1 General

The system shall (DD3071) provide the user with the capability to scroll data within the Plans Display window when the Plans Display window is not large enough to display all entries.

The system shall (DD3072) provide the capability for the user to delete a selected Current Plan, Trial Plan, Replan Trial Plan, or initiated Coordination Plan from the Plans Display.

The system shall (DD3073) provide the capability for the user to delete all Trial Plans and Current Plans from the Plans Display.

The system shall (D**) provide the capability to submit a Host-formatted flight plan message.

3.2.1.1.20.6.6.2 Trial Planning

The system shall (DD3075) provide the capability for the user to create a Trial Plan via the Plans Display.

The system shall (DD3077) provide the capability for the user to resubmit a Trial Plan via the Plans Display.

The system shall (DD3078) provide the capability for the user to specify that a Trial Plan for an aircraft be submitted for periodic APD probe via the Plans Display.

The system shall (DD3079) provide the capability for the user to send a flight plan amendment message via the Plans Display to the Host that is based on a Trial Plan, Coordination Plan, or Replan Trial Plan provided the plan does not contain a downstream speed or altitude maneuver.

The system shall (DD**) provide the capability for the controller to create a Trial Plan from a Current Plan with an adapted restriction removed.

The system shall (DD**) provide the capability for the controller to create a Trial Plan from a Current Plan with an adapted restriction imposed.

The system shall (DD3245) provide the capability for the controller to create a Trial Plan from a Trial Plan with an adapted restriction removed.

The system shall (DD3246) provide the capability for the controller to create a Trial Plan from a Trial Plan with an adapted restriction imposed.

3.2.1.1.20.6.6.3 Display Plans on the Graphic Plans Display

3.2.1.1.20.6.6.3.1 Show Alert Between Two Aircraft

The system shall (DD3082) provide the capability for the user to specify, via the Plans Display, a single alert between two aircraft for display on the Graphic Plan Display.

The system shall (DD3083) provide the capability for the user to remove the display of an alert between two aircraft on the Graphic Plan Display via the Plans Display.

3.2.1.1.20.6.6.3.2 Show All Alerts for a Flight

The system shall (DD3085) provide the capability for the user to graphically display a Current Plan, Trial Plan, Replan Trial Plan, or Coordination Plan route, with all associated alerts

assigned to the sector, as well as any alerts not assigned to the sector on the Graphic Plan Display via the Plans Display.

The system shall (DD3086) provide the capability for the user to remove the display for a Current Plan, Trial Plan, Replan Trial Plan, or Coordination Plan route, with all associated alerts assigned to the sector, as well as any alerts not assigned to the sector on the Graphic Plan Display via the Plans Display.

3.2.1.1.20.6.6.4 Display of Flight Data in Response Display

The system shall (DD3088) provide the capability for the user to display flight data in the Response Display by specifying an aircraft via the Plans Display.

The system shall (DD3089) provide the capability for the user to remove flight data from the Response Display by specifying an aircraft via the Plans Display.

3.2.1.1.20.6.6.5 Automated Coordination

The system shall (DD3091) provide the capability for the user at the initiating sector to send via the Plans Display a Trial Plan or Replan Trial Plan with an optional reason for coordination to another sector in order to request approval or clearance for the Trial Plan amendment.

The system shall (DD3092) provide the capability for the user at the receiving sector to respond to a coordination request from the Plans Display.

The system shall (DD3093) provide the capability for the user to find a received Coordination Plan in the Plans Display.

The system shall (DD**) provide the capability for the user at the initiating sector position to send from the Plans Display a Current Plan and, optionally, a reason for coordination to another sector position.

3.2.1.1.20.7 Graphic Plan Display

The Graphic Plan Display will graphically depict Trial Plans, Replan Trial Plans, Current Plans, Coordination Plans, and problems associated with a Plan and surrounding traffic.

When a graphical route is requested and the Graphic Plan Display is not already displayed, the system shall (DD3096) present the Graphics Plan Display scaled to show the current participants in the problem or problems, and the point of violation for the graphical route requested .

3.2.1.1.20.7.1 Graphic Plan Display - Data

The system shall (DD3098) be capable of displaying the following data in the Graphic Plan Display:

a. A label to indicate Current time or Future time and the selected Future time
b. A linear scale
c. A time box to select Future time
d. A range setting indicator
e. A scale indicator.

The system shall (DD**) provide the capability to display supplemental line segments.

The system shall (DD**) provide the capability to display default sector boundaries to the APD boundary for adjacent URET CCLD ARTCCs.

The system shall (DD3099) be capable of displaying the following route data on the Graphic Plan Display:

a. Graphic depiction of routes
b. Maneuver start point and end point indicators for altitude maneuvers. .
c. Altitude value (including climb/descend indicator) for each altitude maneuver start point
d. Altitude value (including level indicator) for each altitude maneuver end point
e. Maneuver end point indicator for speed maneuvers
f. Speed indicator and value for speed maneuver end point indicators
g. Area of violation for each problem
h. Direction of flight arrows for each area of violation.

The system shall (DD3100) be capable of displaying the following map data in the Graphic Plan Display:

a. Fixes
b. Low altitude airways
c. High altitude airways
d. High altitude sector boundaries
e. Low altitude sector boundaries
f. APD boundaries
g. Special Activities Airspace boundaries with altitude limits
h. Airports
i. Labels for fixes, airports, and Special Activities Airspaces
j. APDIA boundaries
k. Center boundaries
l. Super high altitude sector boundaries
m. Ultra low altitude sector boundaries

The system shall (DD3101) be capable of displaying the following for each aircraft on the Graphic Plan Display:

a. Position symbol, as predicted by the trajectory
b. Data block
c. Leader line connecting the data block and position symbol
d. A Trial Plan ID connected to the position symbol by a leader line
e. Route Preview.

The system shall (DD3102) be capable of displaying the following information in each aircraft data block on the Graphic Plan Display:

a. Alert indicators, containing the number of alerts of each type assigned to the sector and, for those aircraft with alert(s) at this sector, an indication of any alerts assigned to other sectors, and for those aircraft posted on the Aircraft List, an indication of aircraft-to-airspace alerts assigned to other sectors
b. Aircraft ID
c. Altitude as predicted by the trajectory
d. Altitude state information
e. Destination
f. Ground speed as predicted by the trajectory
g. Interim altitude
h. Flight Plan Altitude
i. Time at coordination fix
j. Coordination request received indicator.

3.2.1.1.20.7.2 Graphic Plan Display - Posting, Updating, Deleting

A graphical route shall (DD3104) be displayed on the Graphic Plan Display as a result of a manual action taken by the user.

A graphical route shall (DD3105) be displayed on the Graphic Plan Display when the user creates a Trial Plan via the Graphic Plan Display.

The Graphic Plan Display shall (DD3106) be updated when data blocks, aircraft positions, or graphic routes are changed.

A graphical route shall (DD3107) be removed from on the Graphic Plan Display by the system or as a result of a manual action taken by the user.

A data block for a flight shall (DD**) be displayed on the Graphic Plan Display until the flight exits the sector, regardless of whether the flight has an associated entry on the Aircraft List.

3.2.1.1.20.7.3 Graphic Plan Display - Coding

The following displayed data shall (DD3109) be coded for problem notification:

a. Route to indicate alert status, or non-APD probed status, or the type of alert in which the aircraft is involved, or invalid Trial Plan status
b. Violation Area to indicate type of alert
c. Direction of Flight Arrows to indicate type of alert
d. Position Symbols and Leader lines to indicate alert status or the type of alert in which the aircraft is involved
e. Data blocks to indicate alert status or non-APD probed status or the type of alert in which the aircraft is involved (subject and problem aircraft)
f. Maneuver start point and maneuver end point indicators and labels for user entered maneuvers
g. Trial plan ID to indicate alert status and invalid Trial Plan status.

The following other data shall (DD3111) be coded:

a. Selected data block field
b. Data blocks for flight plans not being probed by APD
c. Data block alert indicators to indicate type of alert
d. Coordination request indicator to indicate alert status of Coordination Plan
e. Data block selected for offset
f. Data block for Category B or Category F inbound flight without CP interfacility flight plan.
g. Data block for a Category F flight with a CP interfacility flight plan based on the flight Category received
h. Airspace boundaries to distinguish active from inactive.
i. To indicate a new entry has been automatically posted on the Aircraft List.

The system shall (DD4234) code the Graphic Plan Display to indicate that the time is set to a future time.

Coding shall (DD**) be applied to the Data Block to indicate Route Highlighting.

Coding shall (DD**) be applied in the Graphic Plan Display to distinguish those aircraft-to-aircraft conflicts that occur on a portion of the route that contains a planned or predicted vertical transition that has not been cleared from those conflicts that occur on a portion of the route that reflects the aircraft's current clearance.

The system shall (DD**) provide an indication to the user on the Graphic Plan Display when a Planned Holding Area exists for an aircraft.

3.2.1.1.20.7.4 Graphic Plan Display - User Functions

3.2.1.1.20.7.4.1 General

The system shall (DD3114) provide the capability for the user to display the position of the flights on the Graphic Plan Display at the current time or at a selectable future time.

The system shall (DD3115) provide the capability for the user to change the scale of the Graphic Plan Display.

The system shall (DD3116) provide the capability for the user to specify a new center point for the map on the Graphic Plan Display.

The system shall (DD3117) provide the capability for the user to remove all route displays from the Graphic Plan Display.

The system shall (DD3118) provide the capability for the user to remove the Graphic Plan Display.

The system shall (DD4235) set the time back to current time when the Graphic Plan Display is re-displayed after being minimized.

The system shall (DD**) provide the capability for the user to convert a speed to/from True Airspeed, Indicated Airspeed, or Mach speed from the Graphic Plan Display.

The system shall (DD**) provide the capability for the user to apply a Planned Holding Area to an aircraft's Current Plan at the aircraft's present position from the Graphic Plan Display.

The system shall (DD**) provide the capability for the user to apply a Planned Holding Area to an aircraft's Current Plan at a designated fix in the aircraft's Current Plan from the Graphic Plan Display.

The system shall (DD**) provide the capability for the user to apply a Planned Holding Area to an aircraft's Current Plan at a designated future location in the predicted route of flight for an aircraft from the Graphic Plan Display.

The system shall (DD**) provide the capability for the user to terminate a Planned Holding Area for an aircraft's Current Plan from the Graphic Plan Display.

The system shall (D**) provide the capability to submit a Host-formatted flight plan message

3.2.1.1.20.7.4.2 Filtering

The system shall (DD3120) provide the capability for the user to display airport labels and/or symbols on the Graphic Plan Display.

The system shall (DD3121) provide the capability for the user to remove the display of airport labels and/or symbols from the Graphic Plan Display.

The system shall (DD3122) provide the capability for the user to display airspace labels on the Graphic Plan Display.

The system shall (DD3123) provide the capability for the user to remove the display of airspace labels from the Graphic Plan Display.

The system shall (DD3124) provide the capability for the user to display airspace altitude limits on the Graphic Plan Display.

The system shall (DD3125) provide the capability for the user to remove the display of airspace altitude limits from the Graphic Plan Display.

The system shall (DD3126) provide the capability for the user to display fix labels on the Graphic Plan Display.

The system shall (DD3127) provide the capability for the user to remove the display of fix labels from the Graphic Plan Display.

The system shall (DD3128) provide the capability for the user to display high altitude airways on the Graphic Plan Display.

The system shall (DD3129) provide the capability for the user to remove the display of high altitude airways from the Graphic Plan Display.

The system shall (DD3130) provide the capability for the user to display low altitude airways on the Graphic Plan Display.

The system shall (DD3131) provide the capability for the user to remove the display of low altitude airways from the Graphic Plan Display.

The system shall (DD3132) provide the capability for the user to display low sector boundaries on the Graphic Plan Display.

The system shall (DD3133) provide the capability for the user to remove the display of low sector boundaries from the Graphic Plan Display.

The system shall (DD3134) provide the capability for the user to display high sector boundaries on the Graphic Plan Display.

The system shall (DD3135) provide the capability for the user to remove the display of high sector boundaries from the Graphic Plan Display.

The system shall (DD3137) provide the capability for the user to apply the Aircraft List Filter on the Graphic Plan Display. Application of the Aircraft List Filter shall (DD3137) result in suppression of data blocks for aircraft except those that are on the Aircraft List, or have an alert assigned to the sector, or are controlled by the sector, or are within the sector's boundaries.

The system shall (DD3138) provide the capability for the user to remove the application of the Aircraft List Filter from the Graphic Plan Display.

The system shall (DD3139) provide the capability for the user to apply the Altitude Filter on the Graphic Plan Display.

The system shall (DD3140) provide the capability for the user to remove the application of the Altitude Filter from the Graphic Plan Display.

The system shall (DD3141) provide the capability for the user to specify the Altitude Filter Limits for the Graphic Plan Display.

The system shall (DD3142) provide the capability for the user to display APD boundaries on the Graphic Plan Display.

The system shall (DD3143) provide the capability for the user to remove the display of APD boundaries from the Graphic Plan Display.

The system shall (DD3144) provide the capability for the user to display route segments for all data blocks on the Graphic Plan Display.

The system shall (DD3145) provide the capability for the user to remove the display of route segments for all data blocks on the Graphic Plan Display.

The system shall (DD**) provide the capability for the user to display APDIA boundaries on the Graphic Plan Display.

The system shall (DD**) provide the capability for the user to remove the display of APDIA boundaries from the Graphic Plan Display.

The system shall (DD**) provide the capability for the user to display center boundaries on the Graphic Plan Display.

The system shall (DD**) provide the capability for the user to remove the display of center boundaries from the Graphic Plan Display.

The system shall (DD**) provide the capability for the user to display super high sector boundaries from the Graphic Plan Display.

The system shall (DD**) provide the capability for the user to remove the display of super high sector boundaries from the Graphic Plan Display.

The system shall (DD**) provide the capability for the user to display ultra low sector boundaries from the Graphic Plan Display.

The system shall (DD**) provide the capability for the user to remove the display of ultra low sector boundaries from the Graphic Plan Display.

The system shall (DD**) provide the capability for the user to remove altitude maneuver start and end point altitude values from the Graphic Plan Display. Altitude maneuver start and end point indicators will continue to be displayed.

The system shall (DD**) provide the capability for the user to remove speed maneuver end point speed values from the Graphic Plan Display. Speed maneuver indicators will continue to be displayed.

The system shall (DD**) provide the capability for the user to display altitude maneuver start and end point altitude values on the Graphic Plan Display.

The system shall (DD**) provide the capability for the user to display speed maneuver end point speed values on the Graphic Plan Display.

3.2.1.1.20.7.4.3 Trial Planning

The system shall (DD3147) provide the capability for the user to create a Trial Plan from the Graphic Plan Display.

The system shall (DD3149) provide the capability for the user to delete a selected Trial Plan, Replan Trial Plan, or Coordination Plan from the Plans Display via the Graphic Plan Display.

The system shall (DD3150) provide the capability for the user to resubmit a Trial Plan from the Graphic Plan Display.

The system shall (DD3151) provide the capability for the user to specify from the Graphic Plan Display that a Trial Plan for an aircraft be submitted for periodic APD probe.

The system shall (DD3152) provide the capability for the user to send to the Host a flight plan amendment message based on the Trial Plan, Replan Trial Plan or Coordination Plan via the Graphic Plan Display.

The system shall (DD3153) provide the capability for the user to graphically create a route only, altitude only, or route and altitude Trial Plan via the Graphic Plan Display.

The system shall (DD**) provide the capability for the controller to create a Trial Plan from a Current Plan with an adapted restriction removed.

The system shall (DD**) provide the capability for the controller to create a Trial Plan from a Current Plan with an adapted restriction imposed.

The system shall (DD3245) provide the capability for the controller to create a Trial Plan from a Trial Plan with an adapted restriction removed.

The system shall (DD3246) provide the capability for the controller to create a Trial Plan from a Trial Plan with an adapted restriction imposed.

3.2.1.1.20.7.4.4 Display Plans On the Graphic Plans Display

3.2.1.1.20.7.4.4.1 Show Alerts Assigned to the Sector for a Flight

The system shall (DD3156) provide the capability for the user to graphically display a Current Plan route, with all associated alerts assigned to the sector, on the Graphic Plan Display for a selected aircraft from the Graphic Plan Display.

The system shall (DD3157) provide the capability for the user to remove the display of a Current Plan route, with all associated alerts assigned to the sector, on the Graphic Plan Display for a selected aircraft from the Graphic Plan Display.

The system shall (DD3158) provide the capability for the user to graphically display a Current Plan route, with all alerts of a specific alert type assigned to the sector, on the Graphic Plan Display for a selected aircraft from the Graphic Plan Display.

The system shall (DD3159) provide the capability for the user to remove the display of a Current Plan route, with all alerts of a specific alert type assigned to the sector, on the Graphic Plan Display for a selected aircraft from the Graphic Plan Display.

3.2.1.1.20.7.4.4.2 Show All Alerts for a Flight

The system shall (DD3161) provide the capability for the user to graphically display a Current Plan route, with all associated alerts assigned to the sector, as well as any alerts not assigned to the sector on the Graphic Plan Display for a selected aircraft via the Graphic Plan Display.

The system shall (DD3162) provide the capability for the user to remove the display of the Current Plan including all associated alerts assigned to the sector, as well as any alerts not assigned to the sector on the Graphic Plan Display for a selected aircraft from the Graphic Plan Display.

3.2.1.1.20.7.4.5 Display Plans in Plans Display

The system shall (DD3164) provide the capability for the user to display a Current Plan or a Coordination Plan, including alerts detected by APD, on the Plans Display via the Graphics Plan Display.

3.2.1.1.20.7.4.6 Display of Flight Data in Response Display

The system shall (DD3166) provide the capability for the user to display flight data in the Response Display for a selected aircraft via the Graphic Plan Display.

The system shall (DD3167) provide the capability for the user to remove the display of flight data in the Response Display via the Graphic Plan Display

3.2.1.1.20.7.4.7 Automated Coordination

The system shall (DD3169) provide the capability for the user to send via the Graphic Plan Display a Trial Plan or Replan Trial Plan to another sector in order to request approval or clearance for the Trial Plan amendment.

The system shall (DD3171) provide the capability for the user at the receiving sector to respond to a coordination request from the Graphic Plan Display.

The system shall (DD3172) provide the capability for the user to find a received Coordination Plan from the Graphic Plan Display.

3.2.1.1.20.7.4.8 Data Block Operations

The system shall (DD3174) provide the capability for the user to suppress all data blocks on the Graphic Plan Display.

The system shall (DD3175) provide the capability for the user to restore the display of all data blocks on the Graphic Plan Display.

The system shall (DD3176) provide the capability for the user to offset a data block and change the length of the leader line on the Graphics Plan Display.

The system shall (DD3177) provide the capability for the user to remove the display of an individual data block that does not have aircraft-to-aircraft alerts assigned to the sector and does not have a Coordination Received Request Outstanding from the Graphic Plan Display.

The system shall (DD3178) provide the capability for the user to restore the display of an individual data block to the Graphic Plan Display.

The system shall (DD4231) provide the capability for the user to activate the automatic offsetting of data blocks on the Graphic Plans Display.

The system shall (DD4232) provide the capability for the user to deactivate the automatic offsetting of data blocks on the Graphic Plans Display.

3.2.1.1.20.8 Response Display

The Response Display will display system messages describing anomalies that result from a user action and responses to user requests for flight data.

3.2.1.1.20.8.1 Response Display - Data

The system shall (DD3182) provide an indication to the user that the Response Display window is not large enough to display all entries.

The system shall (DD3183) be capable of displaying the following error or warning data on the Response Display:

a. Aircraft ID
b. Plan ID
c. Problem ID
d. Statement of the anomaly, referencing command,
e. Reason for anomaly.

The system shall (DD3184) be capable of displaying the following fields for flight data requests for an aircraft in the Response Display:

a. Computer ID
b. Aircraft ID
c. Aircraft Control Designator

d. Number of aircraft, aircraft type, Heavy/TCAS Indicator and equipage
e. Beacon Code
f. True Air Speed
g. Coordination Fix
h. Coordination Time
i. Assigned Altitude, Interim Altitude, Blocked Altitude, or VFR indicator
j. Requested Altitude for Proposed flights
k. Route including destination and time at destination
l. Remarks.

The flight data displayed shall (DD4159) be from the Host flight plan, the interfacility flight plan, or both as determined by user selected option.

When the source of flight data is the interfacility flight plan, the source shall (DD4160) be indicated.

When the previous flight plan for a flight is being displayed, the system shall (DD**) provide an indication that the flight plan that is being displayed contains previous values for one or more fields.

3.2.1.1.20.8.2 Response Display - Posting, Deleting

Entries shall (DD3186) be posted to the Response Display either by the system or in response to a user action.

System message entries shall (DD3187) be removed from the Response Display either by the system after an adaptable time period or as a result of a manual action by the user.

Flight Data Request entries shall (DD3188) be removed from the Response Display either by the system after an adaptable time period or as a result of a manual action by the user.

3.2.1.1.20.8.3 Response Display - Sorting

Response Display entries shall (DD3190) be displayed in order of posting, with the most recent at the top.

3.2.1.1.20.8.4 Response Display - Coding

Coding shall (DD3192) be applied to the Response Display system message entries an adaptable time period prior to being removed by the system.

Coding shall (DD3193) be applied to the Response Display flight data request entries an adaptable time period prior to being removed by the system.

3.2.1.1.20.8.5 Response Display - Exception Processing

When new information is to be conveyed to the Response Display, and the Response Display is suppressed or removed, the system shall (DD3195) force display of the Response Display.

The Response Display shall (DD3196) be removed by the system when it has no entries.

3.2.1.1.20.8.6 Response Display - User Functions

The system shall (DD3198) provide the user with the capability to scroll data within the Response Display window when the Response Display window is not large enough to display all entries.

The system shall (DD3199) provide the capability for the user to remove the Response Display.

The system shall (DD3200) provide the capability for the user to remove an individual entry from the Response Display.

3.2.1.1.20.9 Wind Grid Display

The system will display wind velocity data and sector map data.

3.2.1.1.20.9.1 Wind Grid Display - Data

The system shall (DD3204) be capable of displaying the following data on the Wind Grid Display:

a. Lateral Sector boundaries
b. Fixes
c. Wind data (velocity vector arrows and numerical magnitude in knots)
d. Linear scale
e. Temperature and pressure values (upon user request)
f. Date and time the last update was provided by the National Weather Service

The geomap data displayed in the Wind Grid Display shall (DD**) use the Graphic Plan Display filter settings for sector boundaries and fix labels.

3.2.1.1.20.9.2 Wind Grid Display - Posting, Deleting, Updating

The Wind Grid Display shall (DD3206) be displayed upon request (normal state is suppressed and iconified).

The Wind Grid Display shall (DD3207) initially be displayed with a default altitude and scale factor.

Upon request of temperature and pressure data by the user, the numerical wind magnitude in knots on the Wind Grid Display shall (DD3208) be replaced by temperature and pressure values.

Upon request of wind data by the user, temperature and pressure values on the Wind Grid Display shall (DD3209) be replaced by the numerical wind magnitude in knots.

The system shall (DD3210) update the Wind Grid Display when new wind data is received.

The system shall (DD3211) update the Wind Grid Display when the user selects a new altitude for the display of wind.

The system shall (DD3212) update the Wind Grid Display when the user adjusts the scale of the display.

The system shall (DD3213) update the Wind Grid Display when the user adjusts the map offset of the display.

3.2.1.1.20.9.3 Wind Grid Display - User Functions

The system shall (DD3215) provide the capability for the user to select a new altitude on the Wind Grid Display.

The system shall (DD3216) provide the capability for the user to adjust the display scale of the Wind Grid Display.

The system shall (DD3217) provide the capability for the user to adjust the map center of the Wind Grid Display.

The system shall (DD3218) provide the capability for the user to either select temperature and pressure data, or select wind magnitude data on the Wind Grid Display.

3.2.1.1.20.10 Restrictions Display

The Restrictions Display displays a list of altitude and speed restrictions that apply to the assigned sector and that the assigned sector must apply for surrounding sectors.

3.2.1.1.20.10.1 Restrictions Display - Data

Each entry in the Restrictions Display shall (DD3222) contain the following:

a. The current status of the restriction.
b. The sector(s) or center(s) aircraft are leaving.
c. The sector(s) or center(s) aircraft are entering.
d. The altitude or speed to which aircraft are restricted.
e. The time periods when the restriction is in effect.
f. The class of aircraft which are subject to the restriction.
g. The airports included in the restriction.

3.2.1.1.20.10.2 Restrictions Display - Coding

The restrictions shall (DD3224) be coded to distinguish those that are imposed by the assigned sector on surrounding sectors or centers from those that are imposed on the assigned sector by surrounding sectors or centers.

3.2.1.1.20.10.3Restrictions Display- User Functions

The system shall (DD3226) provide a capability for the user at adapted eligible D-positions to turn restrictions on and off and to revert to the schedule for restrictions imposed on all aircraft. The user will be able to take action on any restriction defined in adaptation.

The system shall (DD3227) provide a capability to display the entire facility's restrictions or filter the restrictions to be displayed in the Restrictions Display.

The system shall (DD**) provide a capability for the user to turn restrictions on and off and to revert to the schedule for a restriction imposed on a specific aircraft. The user will only be

able to take an action on a restriction applicable to the aircraft and which the user has the authority to change.

3.2.1.1.20.11 Airspace Status Display

The Airspace Status Display displays a list of airspaces adapted for probing for conflicts by the facility with the activation status and altitude limits.

3.2.1.1.20.11.1 Airspace Status Display - Data

Each entry in the Airspace Status Display shall (DD3231) contain the following:

a. The airspace identification.

b. The facility and sectors in which the airspace is located.

c. The status (active/inactive/scheduled).

d. The time periods when the airspace is scheduled to be active and adapted schedule.

e. Current altitude limits including the default altitude limits.

3.2.1.1.20.11.2 Airspace Status Display - Coding

An entry in the Airspace Status Display shall (DD3233) be coded to indicate whether the associated airspace is controlled by the local facility.

3.2.1.1.20.11.3 Airspace Status Display- User Functions

The system shall (DD3235) provide a capability for the user at adapted eligible D-positions to change the activation status of an adapted special activities airspace.

The system shall (DD4161) provide a capability for the user at adapted eligible D-positions to change the activation schedule of an adapted special activities airspace.

The system shall (DD3236) provide a capability for the user at adapted eligible D-positions to change the altitude limits of an adapted special activities airspace.

The system shall (DD4267) provide the capability for a user to display special activities airspaces, filtered as specified in the display request from the Airspace Status Display.

3.2.1.1.20.12 Arrival Stream Filter Status Display

The arrival Stream Filter Status Display displays a list of Arrival Stream Filters adapted for the facility and their status.

3.2.1.1.20.12.1 Arrival Stream Filter Status Display - Data

CP shall (DD4280) be capable of displaying the following data for an entry in the Arrival Stream Filter status Display:

a. Arrival Stream Filter name

b. Adapted Arrival Stream Filter description

c. Current status (active/inactive)

3.2.1.1.20.12.2 Arrival Stream Filter Display - User Functions

CP shall (DD4281) provide the capability for the user at adapted eligible D-positions to change the activation status of an Arrival Stream Filter from the Arrival Stream Filter Status Display.

CP shall (DD4282) provide the capability for a user to display Arrival Stream Filters, filtered as specified in the display request from the Arrival Stream Filter Status Display.

3.2.1.1.20.13 Additional User Inputs

CP shall (DD3244) provide the capability for the controller to turn Automated Coordination for the entering sector on or off.

The system shall (DD4228) provide the capability for the user at adapted eligible D-positions to turn CP on or off for the entering D-position.

The system shall (DD4229) provide the capability for the user at adapted eligible D-positions to turn CP on or off for another D-position.

The system shall (DD4230) provide the capability for the user at adapted eligible D-positions to turn Automated Coordination on or off for another D-position.

3.2.1.1.20.13.1 Conflict Acknowledge

CP shall (DD4248) provide the capability for controller input to acknowledge at the entering sector position, a designated conflict.

If a user acknowledges a conflict with a given severity coding, CP shall (DD4249) remove that severity coding for an aircraft involved in the acknowledged conflict if all other conflicts involving that aircraft with the same severity coding have also been acknowledged.

Conflict notification acknowledgement shall (DD4250) remain in effect for the duration of the predicted conflict. CP shall (DD4251) provide the capability for the controller to identify those aircraft for which a predicted conflict is acknowledged.

The system shall (DD**) provide the capability for the user to unacknowledge an acknowledged Conflict or Awareness Notification.

If the user unacknowledges a Conflict or Awareness Notification, the system shall (DD**) apply severity coding for an aircraft involved in the acknowledged conflict.

3.2.1.1.20.13.2 Group Suppression

CP shall (DD4252) provide the capability for the controller to inhibit or enable notification, at the entering position, of conflicts between two or more designated aircraft (group).

When an aircraft is added to a group and a conflict exists between that aircraft and another aircraft already in the group, CP shall (DD4254) remove the corresponding conflict notification from the display for both aircraft. Conflict notification information includes both severity coding and conflict alert count.

When an aircraft is removed from a group and a conflict exists between that aircraft and another aircraft still in the group, CP shall (DD4255) update the display with the corresponding conflict notification for the aircraft removed from the group.

CP shall (DD4256) provide a capability for a sector position to determine the aircraft that are within a group.

CP shall (DD4257) provide the capability for controller to add aircraft to or delete aircraft from an existing group.

3.2.1.1.20.13.3 Conflict Inhibit

CP shall (DD4258) provide the capability for a controller to inhibit or enable the notification, at the entering sector position, of current or future conflicts for a designated aircraft.

If conflict notification information is displayed for an aircraft and that aircraft is selected for inhibit of conflict notification, CP shall (DD4259) remove the conflict notification information displayed for that aircraft. Conflict notification information includes both severity coding and conflict alert count.

If one or more conflicts exist for an aircraft and that aircraft is selected for enable of conflict notification, CP shall (DD4260) update the display with the corresponding conflict notification for that aircraft.

CP shall (DD4261) provide the capability for each sector position to identify those aircraft for which conflict notification is inhibited.

3.2.1.1.21 Training Support

CP will operate in a separate training environment for purposes of training students on the functions of CP outside of the operational environment.

When training is active, the system shall (DD685) inhibit flights associated with one student's training session from interfering with another student's training session. "Inhibit interfering with" means the CP processing of the flights in one student's training session will not affect the CP processing of the flights in another student's session.

When training is active, the system shall (DD685) post flights for which the Ghost Pilot has track control, to the Ghost Pilot's position's Aircraft List.

In the operational environment, the system shall (DD685) inhibit processing of training flights.

When training is active, the system shall (DD685) inhibit processing of non-training flights.

In the training environment, the system shall (DD685) assign airspace to trainee positions and activate or deactivate training based on the TF message received from the HCS. In the operational environment, the system will ignore any TF messages received from the HCS.

3.2.2 Infrastructure Services

The EDI provides common services and data for multiple En Route applications. Functions and data, which are common to more than one application, will be managed within the EDI Infrastructure Services and Infrastructure Display Services. The applications program interfaces (APIs) to EDI infrastructure services will conform to widely accepted standards to support application portability and interoperability. The EDI infrastructure services will be implemented using commercially available software (CAS) whenever such software satisfies EDI performance, reliability and monitor and control requirements.

This EDI capability is intended to reduce or eliminate situations where multiple applications perform the same functions or manage common data in multiple places within the En Route domain.

For data, a single En Route application will be identified as the owning or responsible entity for updating each given data element. The responsible application will utilize EDI Infrastructure data base management functions to update the appropriate EDI-based data which can in turn be accessed by other En Route (or external) applications.

Functions, which reside as part of EDI Infrastructure Services, including Infrastructure Display Services, will be maintained and managed by EDI. Other En Route applications will access Infrastructure Services to perform common functions rather than performing the function within the given application.

Also, in accordance with mandates governing FAA systems development, as well as best practices for cost-effective systems development, maximum use of Commercial Off-The-Shelf (COTS) will be made.

3.2.2.1 Infrastructure Technical Reference Model

The Enhanced DSR Infrastructure (EDI) Technical Reference Model (TRM) enhances the ability to understand how the various technologies relevant to this computer-based system can interrelate and evolve in a structured way. The EDI TRM also provides a mechanism to identify key issues and capabilities associated with EDI applications portability, system scalability, and interoperability. Throughout the remainder of this section, the acronym TRM or the word "model" mean the EDI TRM, unless otherwise specified.

The TRM is not a specific system design. Rather, it establishes a common vocabulary and defines a set of services and interfaces common to the EDI. The TRM can serve to facilitate interoperability between EDI applications, En Route systems, and the systems to which these applications and systems interface. The model can also serve to facilitate portability across development environments and to enhance the ability to reduce duplication and cost through the use of common services.

Developing and utilizing a reference model can be crucial to the successful, effective, and efficient implementation of the CP and other En Route-based applications. This model is designed to permit the En Route Integrated Product Team (IPT) to take advantage of the benefits of open systems and the numerous new and robust technologies available in the commercial marketplace. En Route IPT-wide application of this model can result in substantial cost savings.

The EDI TRM objectives are described below.

Objective 1: Improve User Productivity

User productivity improvements can be realized by applying the following principles:

Consistent User Interface:

A consistent user interface can ensure that all user accessible functions and services can appear and behave in a similar, predictable fashion regardless of application or site. This has the benefits of simplifying training, facilitating the

development of future applications, improving ease of use across applications, and promoting application portability.

Integrated Applications:

Applications available to the various system users can behave in a logically consistent manner across user environments.

Data Sharing:

Data definitions, elements and databases can be shared across systems in order to reduce unnecessary duplication and redundancy -- and associated costs. Concepts and tools that promote data sharing include adherence to a widely supported commercial-standard database interface specification, common database development procedures, the use of IPT data dictionary and software reuse libraries, and strong IPT commitment and policy to encourage resource sharing.

Objective 2: Improve Development Efficiency

The efficiency of development efforts can be improved by applying the following principles:

Common Development:

Applications that are common to multiple environments within the IPT can be centrally developed or acquired.

Common Open Systems Environment:

A standards-based common operating environment can be established which accommodates the injection of new standards, technologies, and applications on an IPT-wide basis. This environment can provide the basis for development of common applications, facilitate software reuse, and enable the acquisition robust and cost-effective commercial hardware and software.

Use of Products:

With appropriately specified infrastructure, commercial software at the system and application level can be used instead of custom software and hardware – and instead of reused custom items (non-developmental items) – in order to satisfy program requirements with reduced development and maintenance costs.

Software Reuse:

For applications that must be custom developed, the development of programs that strictly comply to widely used commercial operating system and database management interfaces can significantly increase the opportunity to reuse that software. A development process that encourages such software can reduce the amount of software developed as well as add to the inventory of software suitable for reuse by other systems.

Resource Sharing:

Automation resources (hardware, software, and data) can be shared by all users requiring the services of those resources.

Objective 3: Improve Portability and Scalability

The portability and scalability of applications can be improved by applying the following principles:

Portability:

Applications that are implemented according to the TRM can be portable, allowing for movement across heterogeneous computing platforms with minimal or no modifications. With portable applications, implementing activities can be able to upgrade hardware platforms – and the platform/operating system combinations – as technological improvements occur, with minimal impact on operations. This can be key to following the rapid systems technology advancement of today's marketplace. From this perspective, the evolution of hardware and software technology is a true advantage to be embraced.

Scalability:

Applications that are implemented according to the TRM can utilize any of a number of platforms, as driven by capacity and reliability requirements. This scalability also is a major element the reduction of agency program risk due to capacity shortfall, identification or necessary modification of system reliability or performance needs, or other unanticipated need.

Objective 4: Improve Interoperability

Interoperability improvements across applications and environments can be realized by applying the following principles:

Common Infrastructure:

The IPT can develop and implement a communications and computing infrastructure based on open systems and systems transparency including, but not limited to, operating systems, database management, data interchange, network services, network management, and user interfaces. The basis for such a common infrastructure is to identify core capabilities having a commonality of application across services. This, in the near term, enables the migration from static and monolithic applications ("stovepipes") to a more open and shareable environment that enables transparent operation across heterogeneous platforms.

Standardization:

By implementing standards from an IPT or agency standards profile, applications can use, or encourage the use of, a common set of services. In the same way, different systems within or external to the IPT can communicate, share data, and share software and hardware and the related training and maintenance. Use of such a set of common services can substantially increase the opportunities for interoperability. In a very real way, standards are a primary means to specify the nature of the TRM – to "implement" the model as a structure for development and reuse of systems and capabilities. While one might conceive of a technical reference model based mostly, or even entirely, on custom-developed pseudo-standards, such a model could eliminate many opportunities for reuse of capabilities without custom "glue programs" developed to interface those

capabilities to the custom system. The intent of a standards profile would be to encapsulate any required custom development behind a standard interface (a widely used commercial standard, in the ideal) rather than encapsulate commercial interfaces within a custom interface.

Objective 5: Improve Security

Security can be improved by using the following principles for automation systems that may need to operate simultaneously in various environments (such as operational, support, training, and maintenance):

Uniform Security Accreditation and Certification:

Uniform certification and accreditation procedures can not only reduce the time needed to approve system operation but can result in more consistent use of security mechanisms to protect sensitive data.

Consistent Security Interfaces:

Consistent security interfaces can reduce learning time when changing from system to system. Not all IPT applications may need the same suite of security features, but any common features used can be used in a consistent across applications.

Support for Simultaneous Processing in Single Platforms of Different Information Domains:

Security protection can be provided for simultaneously processing various categories of information within a single system. Automation systems that can support multiple security policies can support multiple environments that need differing levels of sensitivity. This type of support can also permit users with different security attributes to simultaneously use the system.

Support for Simultaneous Processing in a Distributed System of Different Information Domains:

Security protection can be provided for simultaneously processing various categories of information in a distributed environment, including processing controlled by multiple security policies in distributed networks using heterogeneous platforms and communications networks. This capability can greatly extend the flexibility of the system implementers to provide cost-effective systems based on open systems principles.

Support for Use of Common User Communications Systems:

Security protection can be provided in such a way as to permit use of public commercial common carrier (public) networks. It can also permit the use of agency internal common user networks. This use of public and agency common networks can result in enhanced and cost-effective interoperability across IPT automation environments.

Objective 6: Promote Vendor Independence

Vendor independence can be promoted by applying the following principles:

Interchangeable Components:

Hardware and software supporting or migrating to open systems compliance can be acquired or implemented, so that upgrades or the insertion of new products can result in minimal disruption to the user's environment.

Non-Proprietary Specifications:

Automation capabilities can be defined in terms of non-proprietary specifications that are available to any vendor for use in developing commercial products. This also increases the opportunity to insert appropriate commercial technology with minimal or no development (or modification to current systems hardware or software).

The intent of such approaches is not only to eliminate long-term dependence upon any particular hardware or software commercial vendor, but also to reduce long-term dependence on the prime system development or system integration vendor when an upgrade or integration of a new product or service is required.

Objective 7: Reduce Life-Cycle Costs

Most of the principles discussed above can also be used to reduce life-cycle costs of developing and operating En Route automation systems. In addition, the following principles directly address life-cycle cost reduction:

Reduced Duplication:

Replacing so-called stovepipe systems with interconnected open systems that can share data and other resources can dramatically reduce overlapping functionality, data duplication, and unneeded redundancy.

Reduced Software Maintenance Costs:

Although software complexity – or apparent complexity -- can increase moderately with increased use of distributed processing and distributed database services, should the principles above be implemented, reductions in software maintenance can be realized because there can be less software to maintain. In particular, since the market center has steadily been moving toward such distributed systems, a wealth of experience and commercial products are available – and being developed – that address distributed systems and significant systems interoperability and reuse. Increased use of commercial standard software can further reduce costs since vendors of such software distribute their product maintenance costs across a much larger user base.

Reduced Training Costs:

Training costs can be reduced because system users and maintainers moving to new environments within the IPT can already be familiar with the common systems interfaces and capabilities, along with consistent computer-human computer interfaces (CHIs).

3.2.2.2 Infrastructure Standards Profile

As noted in the preceding section, an infrastructure standards profile can be a key element in the practical and workable specification of an infrastructure and of a technical reference model. Areas in which standards can be necessary include the following:

a. Platform Operating System Standards (e.g., POSIX)
b. Distributed Computing Standards (e.g., CORBA, DCE)
c. Intrafacility Windowing Display Standards (e.g., X11R5, Motif
d. Interfacility Windowing Display Standards (e.g., X11 R6 with LBX)
e. Direct Graphics Display Standards (e.g., OpenGL)
f. System and Network Management Standards (e.g., SNMP, SNMPv2)
g. Availability Management Standards
h. Communications Standards (e.g., Internet Protocol Suite, ISO 8802-2, FAA NAS Open Systems Architecture and Protocols)
i. Wide Area Network Access Standards (e.g., X.25, Frame Relay)
j. Special Case Protocol Standards (e.g., PPP)
k. Data Interchange Standards (e.g., HTML, JPEG, CGM)
l. ARTCC Data Management Standards (e.g., SQL, ODBC)
m. Network and Computer Security Standards
n. Programming Language Standards (e.g., C, C++, Ada, SQL)

3.2.3 Operational Position Capabilities

The following paragraphs are legacy DS requirements which describe the R-Position and A-Position capabilities. They are included for completeness.

3.2.3.1 R-Position Processing Support

The system shall (DD27) provide the capability for the R-Position to operate in one of two display modes: HCS or EDARC.

In Host display mode, the R-Position Display shall (DD28) be generated from Host provided data.

In Host display mode, the R-Position Console entered messages shall (DD29) be sent to the Host for processing.

In the EDARC display mode, the R-Position Display shall (DD30) be generated from EDARC provided data.

In the EDARC display mode, the R-Position entered messages shall (DD31) be sent to EDARC for processing.

A capability shall (DD32) be provided to switch between display modes at the R-Position by a single action taken at the console.

An indication shall (DD33) be provided at the R-Position to denote when the console is operating in the EDARC/EDI display mode (Reference 3.2.3.1.1.3.1, System Status Panel).

3.2.3.1.1 Host Display Mode Processing

The requirements in the following sections shall (DD35) apply while Host display mode is selected at the R-Position.

3.2.3.1.1.1 R-Position Display Layout

The R-Position monitor shall (DD37) provide for the following logical displays:

a. Plan View Logical Display (PVLD) (Reference Sections 3.2.3.1.1.1.1 and 3.2.3.1.1.2.1);

b. R-Position Computer Readout Logical Display (R-CRLD) (Reference Sections 3.2.3.1.1.1.2, 3.2.3.1.1.2.2 and 3.2.3.1.1.2.3);

c. Display Control and Status Logical Display (Reference Sections 3.2.3.1.1.1.3 and 3.2.3.1.1.2.4);

d. Time view;

e. D-position Computer Readout Display (D-CRD) (if adapted to be displayed) (Reference Section 3.2.3.1.1.10);

f. Flight Plan Readout View

The system shall (DD38) provide the capability to simultaneously display all three logical displays on the R-Position monitor.

The size and location of these displays shall (DD39) be adaptable as specified in Section 3.2.3.1.1.9.2.

3.2.3.1.1.1.1 Plan View Logical Display

The system shall (DD41) support a PVLD that covers the entire displayable area on the R-Position monitor.

3.2.3.1.1.1.2 R-Position Computer Readout Logical Display

The R-CRLD will be provided for display of Host messages, display of message inputs, and display and selection of category/functions. The R-CRLD shall (DD43) be composed of at least the following three display areas:

a. Text Area;

b. Category Selection Area; and

c. Message Status Area.

3.2.3.1.1.1.2.1 Text Area

The R-CRLD shall (DD45) provide an area for displaying and entering text with a capacity of at least 22 lines of 25 characters in each line.

The system shall (DD46) allocate at least 20 lines of the text area for display of operational display data from the Host.

The system shall (DD47) allocate at least two lines of the text area as a preview area for displaying controller input messages.

When a category is selected (Reference Section 3.2.3.1.1.3.1.1, Category and Function Controls), the system shall (DD48) use the top 15 lines of the text area to display the adapted ATC function labels corresponding to the selected category.

The function labels shall (DD49) overlay the operational display data from the Host.

The system shall (DD50) continue to display the operational display data from the Host (if any) in lines 16 through 20.

3.2.3.1.1.1.2.2 Category Selection Area

It provides for the display and/or selection of a category (Reference Section 3.2.3.1.1.3.1.1.1, Category Selection, and Section 3.2.3.1.1.3.1.1.2, Category De-Selection). This display area shall (DD52) be suppressible by the controller.

3.2.3.1.1.1.2.3 Message Status Area

This area provides a message waiting light indicator (Reference Section 3.2.3.1.1.2.3, Message Status Indicators).

3.2.3.1.1.1.3 Display Control and Status Logical Display

This display provides the Brightness Controls (located on the current R-CRD and on the PVD Display Adjustment Panel), the System Status Indicators and Mode Keys, the 28 display filter keys, and the eight field select keys and various control switches (i.e., history, vector length, range and leader length).

The Display Control and Status Logical Display shall (DD57) be composed of a Panel Control Area and the following panels:

a. Display Filter Selection Panel;

b. Data Block Field Selection Panel;

c. Display Instrumentation Panel;

d. Brightness Control and

Audible Alarm Volume Control Panel.

Each panel shall (DD58) be individually displayable and suppressible, both individually and as a group.

The Panel Control Area shall (DD59) always be displayed.

3.2.3.1.1.1.3.1 Panel Control Area

The Panel Control Area shall (DD61) provide for the simultaneous display of the Display Mode indicator (Reference Section 3.2.3.1, R-Position Processing Support).

This panel shall (DD62) be located at the top of the Display Control and Status Logical Display.

3.2.3.1.1.1.3.2 Display Filter Selection Panel

The Display Filter Selection Panel shall (DD64) provide for the display of up to 28 adaptable display filter selections (Reference Section 3.2.3.1.1.4.5, Display Filter Settings).

3.2.3.1.1.1.3.3 Data Block Field Selection Panel

The Data Block Field Selection Panel shall (DD66) provide for the display of eight data block field on/off selections (Reference Section 3.2.3.1.1.4, Display Control).

3.2.3.1.1.1.3.4 Display Instrumentation Panel

The Display Instrumentation Panel shall (DD68) provide for the display of the following display settings:

a. Target Position History Number (Reference Section 3.2.3.1.1.4.6, History Selection);

b. FDB Velocity Vector Length (Reference Section 3.2.3.1.1.4.8, FDB Vector Length Setting);

c. Display Range (Reference Section 3.2.3.1.1.4.3, Range Selection);

d. Leader Line Length (Reference Section 3.2.3.1.1.4.7, Leader Line Length Selection).

3.2.3.1.1.1.3.5 Brightness Control Panel

The Brightness Control Panel shall (DD70) provide for the display of brightness settings for at least eight brightness control groups and a brightness control for the entire R-Position Console Monitor (Reference Section 3.2.3.1.1.4.1, Brightness Control).

3.2.3.1.1.1.3.6 Audible Alarms Volume Control Panel

The Audible Alarm Volume Control Panel shall (DD72) provide for the display of the alarm volume setting (Reference Section 3.2.3.1.1.4.9, Audible Alarm Volume Control).

3.2.3.1.1.1.4 Flight Plan Readout View and Functions

DS shall (DD**) support a Flight Plan Readout View on the R-Position Console.

DS shall (DD**) display the Flight Plan Readout View at an adapted initial location for each sector.

DS shall (DD**) display the Flight Plan Readout View based on an adapted size for each sector.

DS shall (DD**) provide the capability for the user to move the Flight Plan Readout View.

DS shall (DD**) provide the capability for the user to display 1 to 5 flight plan readouts from the Host in the Flight Plan Readout View.

DS shall (DD**) provide the capability for the user to delete a single flight plan readout from the Flight Plan Readout View.

DS shall (DD**) provide the capability for the user to delete all of the flight plan readouts displayed in the Flight Plan Readout View.

DS shall (DD**) remove the display of the Flight Plan Readout View when the view contains no entries.

If the Flight Plan Readout View is removed, DS shall (DD**) display the Flight Plan Readout View when the user requests a flight plan readout from the Host.

When the user requests an additional entry be added to the Flight Plan Readout View, DS shall (DD**) expand the view size to accommodate the display of the entire readout.

When the user deletes an entry from the Flight Plan Readout View, DS shall (DD**) contract the view size.

EDI shall (DD**) provide the capability, in adaptation, to define the initial location of the R-Position Flight Plan Readout View independently for each R-Position.

EDI shall (DD**) provide the capability, in adaptation, to define the size of the R-Position Flight Plan Readout View independently for each R-Position.

3.2.3.1.1.2 Host-to-Display Processing

3.2.3.1.1.2.1 Plan View Logical Display (PVLD)

The system shall (DD77) provide for the characteristics and data requirements for this logical display as described in NAS-MD-314, Section 3.1, 3.2, 3.5, 3.6, 3.7, 3.9, 3.12, 3.13, and 3.14; NAS-MD-316, Section 24.0; NAS-MD-320, Sections 6.2.1, 6.2.2, 6.2.3, 6.2.4, and 6.2.5; and NAS-MD-323, Section 4.0.

The system shall (DD78) perform filtering, routing, and display formatting of Host-sent display data.

The system shall (DD79) perform any necessary conversion from Host-sent coordinates to meet the needs of the display generation equipment.

The system Plan View Logical Display presentation shall (DD80) be the same as the existing PVD display presentation.

The system Plan View Logical Display presentation will be the same as the existing PVD display presentation except that it shall (DD81) be possible for the display area to cover the entire displayable area on the physical display.

Where color is used, it shall (DD82) be adaptable.

The system shall (DD85) display "NOT RECEIVING RADAR" on the PVLD when the system determines that radar data is not being received from the Host.

The message shall (DD86) be forced to the PVLD at an adapted location.

The type and duration of emphasis shall (DD87) be set in adaptation.

The system shall (DD88) filter radar targets for display based on:

a. Whether a target is from a live or training radar; and
b. The setting of the Radar Source Type in the Display Constants received from the Host.

3.2.3.1.1.2.2 R-Position Computer Readout Logical Display (R-CRLD)

The system shall (DD90) process the Host-sent data displayed on the R-CRLD and present this data in the top 20 lines of the text area of the R-CRLD.

When function labels are displayed and operational data in a Host message is to be displayed in the top 15 lines of the text area, the system shall (DD91) update the previously saved operational data (Reference Section 3.2.3.1.1.3.1.1.1, item b, Category Selection).

In all other cases, the operational data in the Host message shall (DD92) replace the displayed operational data.

3.2.3.1.1.2.3 Message Status Indicators

The system shall (DD94) process messages received from the Host that control the following message status indicators:

a. Message Waiting;

b. Busy; and

c. Ready.

The system shall (DD95) update the Message Status area accordingly.

The system shall (DD96) support a continuous audible alarm and a chime as specified in the Host message.

The system shall (DD97) activate/de-activate the continuous alarm and sound the chime at the R-Position.

When a message is transmitted to the Host, the Busy indicator shall (DD98) be emphasized.

Upon receipt of a Host acknowledgment for that message, the Busy indicator shall (DD99) be de-emphasized.

3.2.3.1.1.3 R-Position to Host Message Processing

This section specifies the R-Position message entry capabilities for messages that are sent to the Host. The same complement of message types shall (DD104) be available to all R-Position.

The system shall (DD105) provide the R-Position with the capability to compose and enter these messages for transmittal to the Host.

The capabilities specified here may also be used for input of messages processed solely within EDI.

3.2.3.1.1.3.1 R-Position Message Composition and Entry

The system provides the necessary input devices to support the entry of messages. The input devices shall (DD108) accept any alphanumeric and special characters required to compose a message (Reference Section 3.2.3.1.1.3.1.3.1, Character Set).

Each R-Position shall (DD109) be provided with the capability to compose messages using the following input mechanisms:

a. Category and Function Controls

b. Quick Action Key Functions

c. Keyboard

d. Pointing Device, and

e. Keypad Selection Device (KSD)

3.2.3.1.1.3.1.1 Category and Function Controls

Controls shall (DD111) be provided for the selection of a category and function.

There shall (DD112) be ten adaptable category controls.

Associated with each category control there shall (DD113) be up to ten adaptable function controls with one adaptable default function.

For each message type composed using the category/function controls, the system shall (DD114) provide the capability to enter additional information using the alphanumeric keyboard and/or the pointing device.

3.2.3.1.1.3.1.1.1 Category Selection

The capability shall (DD4346) be provided to select a category from the Category Selection Area.

In response to a category selection that has only one function associated with it, the system shall (DD4347) perform the following:

a. The text that is associated with the function will replace the contents of the Preview Area, and
b. The keyboard cursor will be placed at the second character position after the last character in the Preview Area

Category function labels are not displayed for category selections that have only one function associated with it.

In response to a category selection that has more than one function associated with it, the system shall (DD117) perform the following:

a. Emphasize the category selection;
b. Save the currently displayed top 15 lines of the operational display area of the R-CRLD;
c. Display the appropriate ATC function label display;
d. Emphasize the default function on the ATC function label display;
e. Clear the Preview Area;
f. Enter the two letter message abbreviation for the default function in the first two character positions of the Preview Area; and
g. Position the cursor in the fourth position in the Preview Area.

When a new category is selected while a previously selected category is active, the system shall (DD118) clear the Preview Area and replace all data related to the previously selected category with data associated with the new category, as described above for category selection.

3.2.3.1.1.3.1.1.2 Category De-Selection

The capability shall (DD120) be provided to de-select a category from the Category Selection Area by re-selecting while it is active (i.e., currently selected).

The system shall (DD121) de-select the category by the following actions:

a. Remove the category selection emphasis;

b. Clear the Preview Area;

c. Restore the operational display data area of the R-CRLD Text Area; and

d. Return the cursor to the first position of the Preview Area.

3.2.3.1.1.3.1.1.3 Function Control

The system shall (DD123) provide the capability to select a function label from the Text area (when displayed).

The system shall (DD124) emphasize the selected function.

When a function for a given category is active and a different function is selected, the system shall (DD125) remove the emphasis from the previously selected function and emphasize the newly selected function.

When the function symbol is the most recent entry in the Preview Area, it shall (DD126) be cleared and replaced with the new function selection.

Otherwise, the function selection shall (DD127) be displayed in the Preview Area and the cursor advanced two positions.

3.2.3.1.1.3.1.2 Quick Action Key Functions

The Quick Action Key (QAK) functions are intended as short-hand technique for certain entry functions.

The system shall (DD130) provide a mapping of QAK functions to the programmable function keys (Reference Section 3.2.3.1.1.3.1.3.6, Programmable Function Keys).

This mapping shall (DD131) be adaptable on a per position console type (e.g., R-Position).

This mapping shall (DD132) be indicated on the programmable function keys on the keyboard.

The capability shall (DD139) be provided to de-select the quick action function after selection of the two methods as specified below.

a. Selecting the Clear Key.

b. Selecting another QAK function.

When entry of a QAK function corresponds to a complete message, the system shall (DD142) perform the actions as specified below:

a. Clear the Preview Area;

b. Display the QAK two letter message abbreviation for the message in the preview area;

c. Deleted

d. When adapted ATC function labels are displayed in the R-CRLD test area, restore the top 15 lines of the operational display data; and

e. Process the message as if the Enter Key had been selected (Reference 3.2.3.1.1.3.1.3.3, Enter Key)

When a QAK corresponds to a part of a message, the system shall (DD149) perform the actions as specified below.

The QAK shall (DD150) be adapted to permit single or multiple (up to four) pointing device entries.

a. Display the QAK two letter message abbreviation at the current cursor position in the Preview Area;

b. Advance the cursor two positions;

c. If adapted for a single pointing device entry, the keyboard Enter Key or the pointing device Enter Key shall (DD153) terminate the message; and

d. If adapted for multiple pointing device entries, only the keyboard Enter Key shall (DD154) terminate the message.

3.2.3.1.1.3.1.3 Keyboard

The system shall (DD156) provide the capability to compose and enter R-controller messages via the keyboard.

At a minimum, the keyboard shall (DD157) provide the following:

a. The character set required to compose a message;

b. Cursor Control Keys;

c. An Enter Key;

d. A CRLD Acknowledge Key;

e. A Clear Key; and

f. Programmable Function Keys.

3.2.3.1.1.3.1.3.1 Character Set

The system shall (DD159) support the character set required to compose a message as specified in the CDC Specification (FAA-E-2286, Section 3.10.2.2, Keyboard).

3.2.3.1.1.3.1.3.2 Cursor Control

The system shall (DD161) provide a cursor in the Preview Area to indicate the next character position that will be used.

When the cursor is advanced past the last position of the first line in the Preview Area, the cursor shall (DD162) be positioned at the beginning of the next line.

The system shall (DD163) support the following functionality for positioning the cursor on the Preview Area as specified below.

a. The capability shall (DD164) be provided to position the cursor one position to the left of its current position.

b. The capability shall (DD165) be provided to move the cursor one position to the right of its current position.

c. The capability shall (DD166) be provided to position the cursor to the beginning of the second line of the Preview Area.

d. When the cursor is already on the second line, this same capability shall (DD167) position the cursor at the end of the Preview Area and sound the chime.

e. The capability shall (DD169) be provided to move the cursor to the first position of the Preview Area.

The use of the Cursor Control Keys shall (DD170) not affect the data being displayed.

3.2.3.1.1.3.1.3.3 Enter Key

The Enter Key shall (DD172) terminate a message and initiate transmission of a message, (Reference Section 3.2.3.1.1.3.6, Message Transmission).

3.2.3.1.1.3.1.3.4 CRLD Acknowledge Key

Upon selection of the CRLD Acknowledge Key, the system shall (DD174) transmit a CRD acknowledge message to the Host, independent of any message currently being composed in the Preview Area.

3.2.3.1.1.3.1.3.5 Clear Key

Upon selection of the Clear Key, the system shall (DD176) perform the following actions:

a. De-emphasize the Busy, Illegal Entry, and Error indicators;

b. Clear the entire Preview Area of the R-CRLD and return the cursor to the first character position in the Preview Area;

c. Unlock all locked devices, (Reference Section 3.2.3.1.1.3.4, Input Locking/Unlocking);

d. When the See-All function is active, terminate that function; and

e. Restore the operational display data on the R-CRLD.

3.2.3.1.1.3.1.3.6 Programmable Function Keys

The system shall (DD178) support the use of programmable function keys.

The system shall (DD179) associate the appropriate Quick Action Key function to the programmable function keys as defined in adaptation.

3.2.3.1.1.3.1.4 Pointing Device

The system shall (DD181) provide for a cursor positioning/selection device (i.e., pointing device) that includes an Enter Key.

The cursor of the pointing device shall (DD182) be capable of wrapping around the R-Position monitor in both the horizontal and vertical dimension.

The system shall (DD183) provide the capability to reset the cursor of the pointing device to an adapted position on the R-Position monitor.

The system shall (DD184) provide the capability to enter messages via the pointing device Enter Key as defined in adaptation.

The system shall (DD185) determine whether or not multiple pointing devices are supported for QAK functions and category/function selections as defined in adaptation.

Upon selection of the pointing device Enter Key, the system shall (DD187) display a pointing device Enter Key symbol in the Preview Area.

When the pointing device Enter Key terminates a message, the processing described in Section 3.2.3.1.1.3.1.3.3, Enter Key, shall (DD188) be performed.

Using the pointing device, the system shall (DD189) provide the capability to "capture" full data blocks and certain tabular list objects and insert data on the captured object into messages being composed for transmittal to the Host.

The system shall (DD190) provide for the composition and entry of R-Position Console messages without the previous selection of a category/function or Quick Action Key function.

When a category/function or QAK function has not been selected, the pointing device Enter Key shall (DD191) imply an "enter action".

3.2.3.1.1.3.2 Preview Area

The Preview Area shall (DD193) contain the character representation for messages being composed with category/function selections, keyboard, and pointing device.

When processing a character entry, the system shall (DD194) display the data at the current cursor location on the Preview Area and advance the cursor by one position.

When a character is currently being displayed at that position, the character shall (DD195) be replaced by the new character and the cursor is advanced by one position.

When a Category, Function, or Quick Action is selected, a two letter message abbreviation shall (DD198) be inserted in the Preview Area.

The contents of the Preview Area shall (DD199) be displayed until the Enter key is pressed.

The capability shall (DD202) be provided to recall the previously composed message that was accepted.

This message shall (DD203) be displayed in the preview area.

3.2.3.1.1.3.3 Host Message Acknowledgment

Upon receipt of a Host acknowledgment, if a new message has not been initiated, the system shall (DD206) perform the following actions:

a. Restore the sending R-CRLD display area;

b. Clear the Preview Area; and

c. Set the cursor to the first position of the Preview Area.

When a new message is being composed (permitted due to a prior Clear Key action), the receipt of a Host acknowledgment shall (DD207) not cause any change to the Preview Area.

3.2.3.1.1.3.4 Input Locking/Unlocking

While waiting for Host message acknowledgments, the Busy indicator shall (DD210) be emphasized. While waiting for Host message acknowledgement all message composition

actions shall (DD211) be ignored except for input from the Clear and CRLD Acknowledgment Keys.

Input shall (DD212) be allowed and recognized on the receipt of an acknowledgment from the Host or entry of the Clear Key.

3.2.3.1.1.3.5 Message Format and Logic Checks

The system shall (DD214) transmit R-controller messages addressed to the Host without format or logic checks.

3.2.3.1.1.3.6 Message Transmission

The system shall (DD216) transmit a composed message to the Host whenever the Enter Key is selected, a QAK complete message function is selected, or a pointing device enter results in message termination.

The system shall (DD217) format the message in the preview area transmission buffer along with any data collected during enter actions from the pointing device.

3.2.3.1.1.3.7 Keypad Selection Device (KSD)

A keypad will be supported at operational R-position and M&C-C position consoles and be usable by the user at the adjacent D-position (if the D-position exists). Ghost Pilot positions will not have a keypad.

The system shall (DD4313) provide the capability via the KSD to select/deselect a subset of the 28 Host Situation Display filter settings in the Display Filter Selection Panel that have been assigned to filter keys on the keypad. Each keypad filter key can have only one of the 28 Host Situation Display filter settings assigned.

The system shall (DD4314) provide the capability via the keypad (KSD) to increment or decrement the velocity vector setting in the Display Instrumentation Panel for the Host Situation Display.

The system shall (DD4315) provide the capability via the KSD to increment or decrement the Situation Display range setting in the Display Instrumentation Panel for the Host Situation Display.

3.2.3.1.1.4 Display Control

The capability shall (DD220) be provided to change these settings from the corresponding panel (Reference Section 3.2.3.1.1.1.3, Display Control and Status Logical Display).

This section describes the capabilities for display and control of the R-Position display settings.

3.2.3.1.1.4.1 Brightness Control

The system shall (DD223) provide the capability for the interactive brightness adjustment for at least eight brightness groups and a brightness control for the entire R-Position console monitor.

Brightness settings shall (DD224) vary from 0 (dim) to 100 (full bright) in steps of two.

The system shall (DD225) provide the capability to select a brightness group and increment and decrement the brightness for that group.

The system shall (DD226) provide a visual indication of the setting and the selection.

3.2.3.1.1.4.2 Data Block Field Selection

The system shall (DD228) provide the capability for the individual selection of eight full data block field on/off selections.

The system shall (DD229) provide the following:

a. Six field selections representing the alphanumeric character array in the data block;
b. One field selection for full data block position symbol; and
c. One field selection for full data block leader.

The system shall (DD230) provide the capability to select/de-select each of these fields for individual on/off display control.

Emphasis shall (DD231) be applied to the field selection indicator when the field is selected.

3.2.3.1.1.4.3 Range Selection

The system shall (DD233) provide the capability to select the range setting for the PVLD.

The range is defined as the distance from the center of the R-Position monitor to the left or right edge of the displayable area on the monitor. The system shall (DD234) support selection from the following nominal range settings: 6, 9, 14, 20, 30, 50, 60, 75, 100, 125, 150, 200, 250, and 400 nm.

The system shall (DD236) provide a visual indication of the settings and the selection.

3.2.3.1.1.4.4 Plan View Logical Display Centering

The system shall (DD238) provide the capability to select the center point of the PVLD to the position designated by the pointing device.

The system shall (DD240) provide the capability to reset the center of the display to a pre-set, site-adaptable, center point.

3.2.3.1.1.4.5 Display Filter Settings

The system shall (DD242) provide for the selection, and emphasis of display filter settings.

Emphasis shall (DD243) be applied to the display filter setting when the setting is selected and removed from the display filter setting when the setting is deselected.

The system shall (DD244) provide the capability for display of data combinations through individual selection/de-selection of filter settings.

The system shall (DD245) associate filter selection to display data through adaptation.

The data selected are those which the controller wants to have displayed. The Host can force display of data to override display filter settings.

3.2.3.1.1.4.6 History Selection

The system shall (DD248) provide the capability to select the number of histories displayed for all targets.

The number of histories shall (DD249) range from zero to five.

The system shall (DD250) provide a visual indication of the setting and the selection.

3.2.3.1.1.4.7 Leader Line Length Selection

The system shall (DD252) provide the capability to select the leader line length for all full data blocks.

The capability shall (DD253) be provided to select from the following line lengths: 0, 0.625, 1.25, and 2.50 inches.

The system shall (DD254) display the leader length selected by the controller unless one is specified in the received full data block message.

The system shall (DD255) provide a visual indication of the setting and the selection.

3.2.3.1.1.4.8 FDB Vector Selection

3.2.3.1.1.4.8.1 Velocity Vector

The system shall (DD257) provide the capability for the controller to select the displayed vector length by selecting from five pre-programmed multiples of 0, 1, 2, 4, or 8 minutes of flight.

The selection shall (DD258) apply to all FDBS displayed on the PVLD.

The system shall (DD259) provide a visual indication of the setting and the selection.

3.2.3.1.1.4.8.2 Distance Vector

The system shall (DD4318) provide the capability for the controller to select the display of the Distance Vector (six nautical miles) for all displayed FDBs.

When the Distance vector is displayed the Velocity Vector shall (DD4319) be removed from the display.

When the Distance vector is displayed the velocity vector function shall (DD4320) be disabled.

The system shall (DD4321) provide the capability for the controller to remove the display of the Distance Vector for all displayed FDBs.

When the Distance Vector is removed from display, the system shall (DD4322) enable the Velocity Vector function and display the Velocity Vector on al displayed FDBs based on the current setting.

3.2.3.1.1.4.9 Audible Alarm Volume Control

The system shall (DD261) provide the capability for the volume adjustment of the audible alarm (continuous alarm and chime).

Audible alarm volume settings shall (DD262) vary from one to five in steps of one.

The system shall (DD263) provide a visual indication of the setting and the selection.

3.2.3.1.1.5 Quick Look Command

The system shall (DD265) provide the capability for the controller to select/de-select display of full data block data addressed to up to five other sectors simultaneously, in addition to the data addressed to their own sector.

One or more sectors shall (DD266) be selectable at one time.

It shall (DD267) be necessary to deselect previously quick looked sectors when the total number of currently selected sectors exceeds five.

If a controller enters a duplicate sector number in a Quick Look message, the Quick Look sector display shall (DD268) be unaffected.

The full data blocks of the selected sectors shall (DD269) remain on the display until a subsequent Quick Look message with no sectors specified is entered.

When a Quick Look message with no sectors specified is entered, the system shall (DD270) remove all data blocks displayed as a result of a quick look.

The filter settings of the position requesting the quick look shall (DD271) apply to both the quick looked and non-quick looked data.

3.2.3.1.1.6 See-All Display

The system shall (DD273) support entry of a See-All command to allow an authorized sector to see a copy of all views at a target sector.

When the system detects a syntax error, then the system shall (DD274) generate an error message indicating the incorrect syntax in the Text Area of the requesting sector.

When the requesting sector is not authorized to enter a See-All command, then an error message indicating that the requested sector is not authorized, shall (DD275) be displayed in the Text Area of the requesting sector.

When the target sector identification is the same as the requesting sector identification, then an error message indicating that it is not valid to See-All your sector, shall (DD276) be displayed in the Text Area of the requesting sector.

When the requesting sector is authorized to enter a See-All command, but the target sector does not have an assigned R-Position, then an error message indicating that the target sector is unassigned, shall (DD277) be displayed in the Text Area of the requesting sector.

When the requesting sector is authorized to enter a See-All command, but the target sector is not a valid sector number, then an error message indicating that the target sector is invalid, shall (DD278) be displayed in the Text Area of the requesting sector.

When the See-All command is processed successfully, a message shall (DD279) be displayed at the top of the R-Position Monitor indicating that the sector is in a "See All" mode of the target sector.

Termination of the See-All function shall (DD280) remove the target sector's views and restore the views of the requesting sector in the sizes and locations that they were in prior to the See-All.

3.2.3.1.1.7 Overload Handling

The system shall (DD282) provide the capability to monitor and shed loads at two levels: based on system-wide resource utilization and on individual display utilization's.

Two adaptable threshold limits, upper and lower, shall (DD283) be available for each level of overload handling.

When the upper threshold for an individual R-position's display is exceeded, the system shall (DD284) use an adapted, prioritized list of display data to initiate load shedding.

The lowest priority data shall (DD285) be shed first.

To prevent load oscillation, display data from the prioritized list shall (DD286) be added at an adapted time interval to the workload that is shed until the display load is below the lower threshold.

Upon initiation of load shedding, a display overload indicator shall (DD287) be reported at the Monitor and Control Position.

When the R-position's display load decreases below the lower threshold, previously shed display data shall (DD289) be restored to the display in reverse order.

To prevent load oscillation, display data from the prioritized list shall (DD290) be added at an adapted time interval to the workload that is restored until all previously-shed display data have been restored.

When the upper system-wide threshold is exceeded or the upper individual display thresholds are exceeded for an adapted parameter percentage of displays, the system shall (DD291) initiate system-wide load shedding.

This system-wide load shedding shall (DD292) use the existing Host capability.

3.2.3.1.1.8 Weather and Radar Processor (WARP) Product Display

The Plan View Logical Display shall (DD294), at the option of the controller, display the weather products obtained from the WARP as specified below. WARP is a processor planned for the ARTCCs which will forward NEXRAD radar data to systems within the ARTCC.

a. Reflectivity Mosaic: The system will be provided with four Reflectivity Mosaic products. Three of the products, referred to as Layer Composite Reflectivity Mosaics, represent distinct altitude layers, each with three levels of intensity. The fourth product, referred to as the Composite Reflectivity Mosaic, represents a combination of the three altitude layers at three levels of intensity.

   The capability shall (DD296) be provided for the controller to display the three intensity levels for the selected reflectivity product in the following combinations, with level one being the lowest level of intensity:

   1) Levels one, two, and three;
   2) Levels two and three; and
   3) Level three.

   The display of multiple levels of weather intensity shall (DD297) be made distinguishable by differentiating color, brightness, or shading.

The Reflectivity Mosaic shall (DD298) be presented on the Plan View Logical Display as filled, shaded areas.

Color and shading patterns applied to the areas shall (DD299) be adaptable.

b. NEXRAD Coverage Map: The system will be provided with a WARP product containing an indication of the locations where NEXRAD coverage exists. Each 128 by 128 nautical mile block in the NEXRAD Coverage Map contains a flag that is set if any areas within the block are not covered due to a temporary outage of a radar.

The system shall (DD301) use this product to provide the controller with the capability to display areas where NEXRAD coverage does not exist and areas where measured precipitation is zero.

These areas of no coverage shall (DD302) be presented on the Plan View Logical Display as filled, shaded areas.

Color and shading pattern shall (DD303) be adaptable.

If the controller has selected display of any Reflectivity Mosaic product on the Plan View Logical Display and if a block in the NEXRAD Coverage Map contains a flag that is set to indicate an area not covered due to temporary outage of a radar, then the NEXRAD Coverage Map shall (DD304) be forced into the Plan View Logical Display.

The system shall (DD305) provide an adaptation parameter to enable or disable this forcing feature.

The capability shall (DD306) be provided for the controller to display the Reflectivity Mosaic and the NEXRAD Coverage Map individually and concurrently.

The system shall (DD307) delete WARP products in response to any updates that automatically supersede older products from the WARP.

The system shall (DD308) delete WARP products when updates are not received from the WARP after an adaptable period of time.

It shall (DD309) be possible to display the WARP products on a Plan View Logical Display concurrently with ATC Radar weather data with no loss of information.

The resolution of the WARP products shall (DD310) be preserved.

For display overload handling, each Reflectivity Mosaic intensity level and NEXRAD coverage mosaic shall (DD311) be defined as a unique display data item and handled as defined in Section 3.2.3.1.1.7, Overload Handling.

The system shall (DD313) provide an indication to the controller whenever weather updates are not being received from WARP.

3.2.3.1.1.9 Adaptation

The system adaptation data base will be provided from the following two sources:

a. Files that are sent by the Host; and
b. Adaptation files provided by the system.

3.2.3.1.1.9.1 Host Files

The system shall (DD319) accept data base files sent by the Host.

The system shall (DD320) accept and store the following information:

a. Radar Site Data;
b. PVD Center Information; and
c. Sector assignments.

The data shall (DD321) be drawn from Host adaptation for the display channel and shall support both the Display Channel Complex (DCC) and the Computer Display Channel (CDC) adaptation.

3.2.3.1.1.9.2 New Adaptation Files

3.2.3.1.1.9.2.1 Color Map

When color is used, the system shall (DD325) provide the capability to adapt the mapping of color definition for the various display data that are received from the Host.

3.2.3.1.1.9.2.2 Logical Display Size and Location

The system shall (DD327) provide the capability to adapt size and location for each logical display independently on each physical display at the R-Position and A-Position.

The system shall provide the capability to independently adapt the font sizes used at each D-Position.

3.2.3.1.1.9.2.3 Brightness Control

The system shall (DD329) provide the capability to adapt mapping of brightness control groups to the various display data that is received adaptation.

3.2.3.1.1.9.2.4 WARP Product Deletion Time-out

The time-out value for deletion of WARP products shall (DD331) be site-adaptable.

3.2.3.1.1.9.2.5 Display Data Priority Mapping

The system shall (DD333) provide the capability to adapt mapping of priority levels to display data for use by load shedding.

3.2.3.1.1.9.2.6 WARP, NEXRAD Coverage Map Forced Display Parameter

The system shall (DD335) provide the capability to adapt a parameter used to enable or disable the forced display of the NEXRAD Coverage Map as specified in Section 3.2.3.1.1.8, WARP Product Display.

3.2.3.1.1.9.2.7 QAK and Category Key/Programmable Function Key Mapping

The system shall (DD338) provide the capability to map, by adaptation, each Quick Action Key function to a programmable function key.

The system shall (DD339) provide the capability to specify in adaptation the two letter message abbreviation that is echoed when a Quick Action Key is selected.

There shall (DD340) be three facility-wide mappings for Quick Action Keys, one each for the R, D, and A-positions.

The system shall (DD341) provide the capability to adapt the categories and the functions mapped to those categories.

The capability shall (DD342) be provided to adapt the mapping of functions to programmable function keys.

In addition, the system shall (DD343) provide the capability to specify in adaptation the two letter abbreviation that is echoed when a function is specified.

There shall (DD344) be one facility-wide mapping for the Category keys and functions that are associated with each category for the R-position.

3.2.3.1.1.9.2.8 Filter Key Mapping

The system shall (DD346) provide the capability to adapt the association of 28 filter keys to PVLD data.

3.2.3.1.1.10 D-Position Computer Readout Display (D-CRD)

The D-CRD view at the R-position provides the capability to display the first nine lines of the D-CRD-UA and the D-CRD-UA Message Waiting indicator area at the R-position. The D-CRD view is displayed at an adapted initial location and size for each R-position and Ghost Pilot workstation that has adapted the view. The displaying of the D-CRD view at an R-position or Ghost Pilot workstation is optional. The D-CRD view can be moved as an entity from its initial location via the DS Move command.

The D-CRD view will be composed of at least the following areas:

a. D-CRD Message Waiting Light indicator area
b. D-CRD text area.

The D-CRD Text Area shall (DD4328) be optionally adaptable at an R-position or Ghost Pilot workstation.

3.2.3.1.1.10.1 Text Area

The D-CRD Text Area shall (DD4329) consist of at least nine lines of 25 characters each to display message data transmitted by the Host.

The D-CRD Text Area shall (DD4330) be updated with message data (first 9 lines of the D-CRD) from the Host.

The system shall (DD4331) provide the capability for the user to suppress the D-CRD Text Area.

3.2.3.1.1.10.2 D-CRD Message Waiting Indicator

The D-CRD Message Waiting indicator area shall (DD4332) be emphasized or de-emphasized based on message data received from the Host.

The system shall (DD4333) provide the capability for the user to suppress the D-CRD Message Waiting indicator area.

3.2.3.1.2 EDARC Display Mode Processing

The requirements in the following sub-sections shall (DD348) apply while the EDARC display mode is selected at the R-position console.

3.2.3.1.2.1 EDARC-to-Display Processing

The R-Position Plan View Logical Display shall (DD350) be presented identically to the EDARC-generated Plan View Display as defined in NAS-MD-1314.

When color is used, it shall (DD351) be used in the same way as specified for the Host-Mode PVLD.

All capabilities for display data selection and control of the display presentation, such as display data filtering, range selection, display center selection, and FDB field selection, available at the PVD when operating with EDARC shall (DD352) also be available at the R-Position.

With the exception of map off center, the system shall (DD353) maintain the same selections between the two display modes.

The CHI for display data selection/control actions shall (DD354) be identical for the two display modes.

3.2.3.1.2.2 R-Controller Inputs

All R-control message composition and message entry capabilities available at the EDARC PVD, as defined in NAS-MD-1311, shall (DD356) be available at the R-Position.

The syntax of messages entered at the R-Position shall (DD357) be the same as at the PVD when operating with EDARC.

3.2.3.1.2.3 Adaptation

The adaptation requirements of Section 3.2.3.1.1.9.2.1 (Color Map), Section 3.2.3.1.1.9.2.3 (Brightness Control) shall (DD359) apply to the EDARC mode processing.

The requirements of Section 3.2.3.1.1.9.2.2 (Logical Display Size and Location) shall (DD360) apply to the system EDARC processing mode except where display locations are determined by EDARC.

3.2.3.2 D-Position and A-Position Processing Support

The system shall (DD363) provide the capability for the D-Position and the A-Position to communicate with the Host.

3.2.3.2.1 D-Position Display Layout

The D-Position shall (DD365) provide for the following logical displays:

a. D-Position Computer Readout Logical Display Message Composition Area (D-CRLD-MCA);
b. Display Control Logical Display;
c. Time Logical Display;

d. D-Position Computer Readout Logical Display Update Area (D-CRLD-UA); and

e. Conflict Probe Displays (see Conflict Probe Computer Human Interface section 3.2.1.1.20).

Each logical display will be a window on the D-position display.

The font sizes used at the D-position display for DS displays, such as the Time and CRLD-UA displays. shall (DD370) be adaptable.

Each window shall (DD3357) have an initial default location.

Each CP window shall (DD**) have an initial default size.

The system shall (DD3358) provide the capability for the user to move a "displayed" window.

The system will be capable of placing an existing window with entries in one of two states: "displayed" (present on a display surface), or "suppressed" ("iconified").

The system shall (DD3360) provide the capability for the user to suppress and restore windows.

The system shall (DD3361) provide the capability for the user to scale the size of a window.

The capability for the user suppress or scale the size of a window may not apply to some views.

When scaling the size of a window, the character size of the data shall (DD**) remain the same.

Every window shall (DD3364) have a unique label.

Windows shall (DD65) be opaque, obscuring lower level display windows.

The system shall (DD3366) provide the capability to modify the stacking order of displayed windows.

Information coding will be used in a consistent manner across all D-side views.

The system will provide pointing device shortcuts and keyboard shortcuts to commonly used commands.

3.2.3.2.1.1 D-Position Computer Readout Logical Display Message Composition Area Layout

The D-CRLD-MCA will be provided for the display of Host messages and the entry of controller messages. The D-CRLD-MCA shall (DD372) provide two display areas as specified below.

When the window containing the D-CRLD-MCA View has the focus, the capability for the user to enter and receive Host and display system processed messages in the D-CRLD-MCA View (DD3368) shall be provided.

3.2.3.2.1.1.1 Message Composition Area and Response Area

The D-CRLD-MCA shall (DD374) provide an area for displaying and entering text with a capacity of at least 11 lines of 25 characters in each line.

The system shall (DD376) allocate at least 6 lines of the text area to display message data in the D-CRLD-MCA transmitted by the Host.

The system shall (DD377) allocate at least five lines of the text area as a preview area for displaying controller inputs.

3.2.3.2.1.1.2 Message Status Area

The requirements of Section 3.2.3.1.1.1.2.3 (Message Status Area) shall (DD379) apply to the D-Position.

3.2.3.2.1.2 Display Control Logical Display

This logical display shall (DD383) provide for the display of brightness and audible alarm volume settings.

The DSR Display Control View shall (DD3374) allow the pointing device and its cursor to be used to adjust the alarm volume.

3.2.3.2.1.3 Time Logical Display

This logical display shall (DD385) contain the coordinated universal time (UTC).

The system shall (DD3376) prohibit suppression of the Time View.

3.2.3.2.1.4 D-Position Computer Readout Logical Display Update Area (D-CRLD-UA)

The D-CRLD-UA will be provided for the display of messages from the Host, and the display of Message Status Area. The D-CRLD-UA will be composed of at least the following display areas:

a. Message Waiting Indicator
b. Test Area.

3.2.3.2.1.4.1 Message Status Area

The requirements of Section 3.2.3.1.1.1.2.3 (Message Status Area) shall (DD379) apply to the D-Position.

3.2.3.2.1.4.2 Text Area

The system shall (DD4290) allocate at least 9 lines of the text area to display message data in the D-CRLD-UA transmitted by the Host.

3.2.3.2.1.5 Additional Indicator

An indicator shall (DD3378) be displayed on the D-position display when:

a. the D-CRLD has been iconified and a message is waiting to be displayed in the update portion of the D-CRD View Text Area, or
b. the Message Waiting indicator is not currently displayed and a message is waiting to be displayed in the update portion of the D-CRLD View Text Area

3.2.3.2.2 A-Position Display Layout

The A-Position shall (DD387) provide for the following logical displays:

a. A-Position Computer Readout Logical Display (A-CRLD);

b. Display Control Logical Display; and

c. Time Logical Display.

The size and location of these Logical Displays shall (DD392) be adaptable as specified in Section 3.2.3.1.1.9.2.2, Logical Display Size and Location.

3.2.3.2.2.1 A-Position Computer Readout Logical Display

The A-CRLD will be provided for the display of Host messages and the entry of controller messages. The A-CRLD shall (DD394) consist of two display areas as specified below.

3.2.3.2.2.1.1 Text Area

The A-CRLD shall (DD396) provide an area for displaying and entering text with a capacity of at least 20 lines of 25 characters in each line.

The system shall (DD397) allocate at least 11 lines of the text area to display message data transmitted by the Host.

The system shall (DD398) allocate at least nine lines of the text area as a preview area for displaying controller inputs.

3.2.3.2.2.2 Display Control Logical Display

This logical display shall (DD404) provide for the display of brightness and audible alarm volume settings.

3.2.3.2.2.3 Time Logical Display

This logical display shall (DD406) contain the coordinated universal time.

3.2.3.2.3 Host-to-Display Processing

3.2.3.2.3.1 D-Position Computer Readout Logical Display (Message Composition Area and Update Area)

The system shall (DD409) process the Host-sent data displayed and present this data in the D-CRLD-MCA or the D-CRLD-UA.

Data received from the Host shall (DD410) overwrite previous operational display data.

3.2.3.2.3.2 A-Position Computer Readout Logical Display

The system shall (DD412) process the Host-sent data displayed on the A-CRLD and present this data in the top 11 lines of the text area of the A-CRLD.

Data received from the Host shall (DD413) overwrite previous operational display data.

3.2.3.2.3.3 Message Status Indicators

The requirements of Section 3.2.3.1.1.2.3 (Message Status Area) shall (DD415) apply to the D-Position and A-Position.

3.2.3.2.4 D-Position and A-Position to Host Message Processing

3.2.3.2.4.1 Message Composition and Entry

The system provides the necessary input mechanisms to support the entry of messages to the Host. The input devices shall (DD418) accept any alphanumeric and special characters required to compose a message up to the maximum specified for the Preview Area.

Messages shall (DD419) be transmitted to the Host only when the controller selects the Enter Key.

Each D-Position and A-Position shall (DD420) be provided with the capability to compose messages using the following input mechanisms:

a. Keyboard; and

b. Quick Action Key Functions.

For the D-Position, the capability shall (DD3395) also be provided to compose messages using the Pointing Device.

3.2.3.2.4.1.1 Keyboard Input

The requirements specified in Section 3.2.3.1.1.3.1.3 (Keyboard Input), and the corresponding sub-sections, shall (DD423) apply to the D-Position and the A-Position.

References to the R-CRLD shall (DD424) refer to the D-CRLD-MCA, D-CRLD-UA and A-CRLD as appropriate, depending on the source of the message input.

3.2.3.2.4.1.2 Quick Action Key Functions

The system shall (DD426) provide a mapping of Quick Action (QAK) functions to the programmable function keys (Reference Section 3.2.3.1.1.3.1.3.6, Programmable Function Keys).

This mapping shall (DD427) be adaptable on a per position console type (e.g., D-Position , A-Position).

This mapping shall (DD428) be indicated on the Quick Action Function Logical Display or on the keyboard.

The capability shall (DD436) be provided to de-select the quick action function after selection by the two methods as specified below.

a. Selecting the Clear Key

b. Selecting another QAK function.

When a QAK corresponds to a part of a message, the system shall (DD439) perform the actions as specified below:

a. Display the QAK two letter message abbreviation at the current cursor position of the Preview Area.

b. Advance the cursor to the fourth position.

3.2.3.2.4.2 Preview Area.

The requirements specified in Section 3.2.3.1.1.3.2 (Preview Area) shall (DD449) apply to the D-CRLD-MCA and the A-CRLD.

3.2.3.2.4.3 Message Acknowledgment.

Receipt of an acknowledgment to a message from the Host shall (DD452) result in no changes to the D-CRLD-MCA or the A-CRLD Preview Area, dependent on the source of the message input.

3.2.3.2.4.4 Input Locking/Unlocking

The requirements specified in Section 3.2.3.1.1.3.4 (Input Locking/Unlocking), shall (DD455) apply to the D-Position and A-Position.

3.2.3.2.4.5 Message Logic and Format Checks

The system shall (DD457) transmit messages entered at the D-Position and A-Position to the Host without format or logic checks.

3.2.3.2.4.6 Message Transmission

The requirements specified in Section 3.2.3.1.1.3.6 (Message Transmission), shall (DD459) apply to the D-Position and A-Position.

3.2.3.2.5 Display Control

This section describes the capabilities for the control of brightness and alarm volume at the D-Position and the A-Position. Some or all of these controls may be provided through hardware at the Contractor's option. If implemented through hardware, the requirements for corresponding display panels shall (DD461) not apply.

3.2.3.2.5.1 Alarm Volume Control

The system shall (DD469) provide the capability to control the volume for the audible alarm (continuous alarm and chime) at the D- and A-Positions.

Audible alarm volume settings shall (DD470) vary from one to five in increments of one.

3.2.3.2.6 Flight Strip Printing Capability

The system shall (DD472) provide a capability to print Host-sent data on paper flight strips.

This capability is currently provided via FDIO Flight Strip Printers. The physical characteristics of the Flight Strip Printers are specified in Section 3.2.9.8.1 (Flight Strip Printer).

3.2.3.3 Ghost Pilot Workstation

The system shall (DD2427) provide the capability for a Ghost Pilot Workstation (GPW).

The Ghost Pilot Workstation shall (DD2428) meet all of the requirements defined for the R-position except as indicated in the following sections. (R-Position Requirement[s])

3.2.3.3.1 EDARC Mode Processing Support

The Ghost Pilot workstation is not required to operate in the EDARC display mode. (Section 3.2.3.1.2, EDARC-to-Display Processing).

3.2.3.3.2 Plan View Logical Display

The PVLD is not required to cover the entire displayable area. (3.2.3.1.1.1.1, Plan View Logical Display, and 3.2.3.1.1.2.1 Plan View Logical Display (PVLD))

3.2.3.3.3 See-All Display

The Ghost Pilot workstation is not required to support the See-All Display Command. (3.2.3.1.1.6, See All Display)

3.2.3.3.4 Overload Handling

Display workload shedding requirements do not apply to the Ghost Pilot workstation. (3.2.3.1.1.7, Overload Handling)

3.2.3.3.5 Weather and Radar Processor (WARP) Product Display

The requirements for WARP product display do not apply. (Sections 3.2.3.1.1.8,Weather and Radar Processor (WARP) Product Display; 3.2.3.1.1.9.2.4, WARP Product Deletion Time-out; and 3.2.3.1.1.9.2.6, WARP, NEXRAD Coverage Map Forced Display Parameter)

3.2.3.3.6 Performance

Performance requirements related to display workload, response times, and reserve capacity do not apply. (3.2.3.1, R-Position Processing Support)

3.2.4 System Operations

3.2.4.1 Integrated Monitor & Control Capabilities

The system shall (DD476) provide an EDI Monitor & Control (M&C) position to perform the physical management and control of the system.

All M&C sub-positions shall (DD3432) retain current capabilities.

The EDI M&C function shall (DD3433) provide the capability to monitor and control with the same computer human interface (CHI) functionality as the DS M&C.

When the CP function is unavailable due to a system failure or scheduled outage, access to and the performance of the EDI M&C functionality and displays shall (DD3434) continue to be satisfied.

3.2.4.1.1 M&C Position Description

The M&C position shall (DD478) consist of the following three sub-positions:

a. M&C Certification (M&C-C) sub-position
b. Host/EDI Path M&C (M&C-H) sub-position
c. EDI/EDARC Path M&C (M&C-E) sub-position

The M&C position shall (DD2453) consist of four workstations, three of which are available to be configured as M&C-H and M&C-E sub-positions.

The EDI M&C position will have the capability to operate in one of two display modes: Host/EDI or EDI/EDARC.

A capability shall (DD2455) be provided to switch between display modes at the EDI M&C position by a single action taken at that position.

An indication shall (DD2456) be provided at the DSR M&C position to denote whether the position is operating in either the EDARC/EDI or the Host/DS/EDI display mode.

3.2.4.1.1.1 M&C Certification (M&C-C) Sub-Position

The M&C Certification (M&C-C) sub-position shall (DD480) consist of at least one position, identical in configuration to the DS R-Position.

The M&C-C sub-position shall (DD481) meet all functional and performance requirements for R-Position processing as specified in Section 3.2.3.1, R-Position Processing Support.

3.2.4.1.1.2 Host/DS/EDI Path M&C (M&C-H) Sub-position

The Host/EDI Path M&C (M&C-H) sub-position shall (DD483) consist of up to three identical workstations to accomplish system monitoring and control of resources on the Host/EDI data path only.

The Host/EDI M&C-H workstations shall (DD484) be identical to the workstations used for the EDARC/EDI Path M&C (M&C-E) workstations.

All M&C-H workstations shall (DD485) be configurable to support any of the monitoring and control functions on the Host/EDI data path as referenced in Sections 3.2.4.1.2, Monitoring Capabilities and 3.2.4.1.3, Control Capabilities and Section 3.2.4.1.4, M&C Computer Human Interface.

The EDI/CP Monitor and Control (M&C) capability shall (DD3439) be integrated into the existing M&C-H sub-positions.

3.2.4.1.1.3 EDARC Path M&C (M&C-E) Sub-position

The EDARC/EDI Path M&C (M&C-E) sub-position shall (DD487) consist of up to three identical workstations to accomplish system monitoring and control of resources on the EDARC data path only.

All M&C-E workstations shall (DD488) be configurable to support any of the monitoring and control functions on the EDARC data path as referenced in Sections 3.2.4.1.2, Monitoring Capabilities and 3.2.4.1.3, Control Capabilities and Section 3.2.4.1.4, M&C Computer Human Interface.

3.2.4.1.1.4 Hard Copy Print Capability

The EDI shall (DD490) provide a separate hard copy print capability for both the Host/EDI and the EDARC/EDI paths to allow printing of operator-selected M&C textual output, including displayed error and status messages.

3.2.4.1.2 Monitoring Capabilities

This section specifies the requirements for system monitoring by the EDI. This section is organized according to the three major functional components of system monitoring:

a. Data acquisition
b. Status determination
c. Data reporting

"Data acquisition" is a continuous process that obtains sensor and derived data parameters from the EDI. Data acquisition may operate by simply sampling the parameters of the EDI or may involve active stimulation of the system to acquire parameters that otherwise would not be obtained during normal system operation. The M&C position will monitor a parameter set that collectively determines the operational status of each subsystem hardware component, each software component, and each external interface. All acquired parameters are available for performance data reporting.

Certain acquired parameters are further processed by "status determination". One of two status determination subfunctions will be performed depending on the type of parameter.

a. Change of state determination will examine non-alarmable parameters to determine if there has been a change in state of the monitored subsystem. A change of state event will be declared for a parameter of interest when its value has changed during the current data acquisition cycle.
b. Alarm/normal determination will examine all alarmable parameters to determine if they are operating in tolerance. For such parameters an alarm or a normal condition will be declared by using pre-established condition status determination criteria.

Data reporting functions provide both unrequested notifications and requested reports. Declared change of state events is reported on occurrence. Declared alarm, and normal conditions are compared with previously reported conditions and are reported if there is a change from the last report. Performance data reports are provided on request for a specific set of monitored parameters or for a pre-defined global set of parameters. The most recently derived subsystem status is provided on request. The system will also provide control parameters, e.g., thresholds, counters, and timers, etc.

3.2.4.1.2.1 Data Acquisition

a. The system shall (DD503) monitor parameters required to determine the operational status of each hardware component of the EDI, at a minimum, to the lowest replaceable unit (LRU) level.
b. The system shall (DD504) monitor parameters required to determine the operational status of each software component of the EDI.
c. The system shall (DD505) monitor parameters required to determine the operational status of each external system interface of the EDI.
d. The system shall (DD506) monitor parameters required to determine the current system configuration, including hardware and software

identification, connectivity of all reconfigurable resources, and which data path has been selected by each controller position.

e. The system shall (DD508) monitor parameters required to derive the status of the EDI M&C position.

f. The system shall (DD509) monitor parameters required to derive the availability status of each operational function of the EDI (e.g., air traffic control functions, EDI applications, software loading, software testing, software cutover, and system analysis recording).

g. The system shall (DD510) monitor parameters required to derive the system-level status of the EDI.

h. The system shall (DD511) monitor parameters required to certify the EDI.

i. The system shall (DD512) monitor parameters of all redundant equipment (e.g., alternate data paths or channels) of the EDI.

j. The system shall (DD513) perform data acquisition on a continuing basis concurrent with the operation of the EDI.

k. The system shall (DD514) perform data acquisition while meeting the Performance Requirements stated in Section 3.2.5, Performance.

l. The system shall (DD515) perform data acquisition automatically without the need for operator intervention.

3.2.4.1.2.2 Status Determination

The system will process acquired data to determine alarm/normal conditions and state change events of the EDI as described in the following sections.

3.2.4.1.2.2.1 Alarm/Normal Status Determination

The system will determine the alarm/normal condition of a sensor parameter or a derived parameter using pre-established criteria (e.g., by comparing parameter values with pre-stored threshold values).

a. The system shall (DD520) automatically declare an alarm condition when a monitored parameter value is outside the acceptable operating range.

b. The system shall (DD521) automatically declare a normal condition when a monitored parameter is within its acceptable operating range.

c. The system shall (DD522) perform filtering (e.g., sampling, sliding window) to minimize the declaration of alarms caused by transient conditions.

d. The system shall (DD524) derive the M&C position status on a continuing basis.

e. The system shall (DD525) determine when the M&C position is not available.

f. The system shall (DD526) determine when the M&C position is degraded.

g. The system shall (DD527) determine when the M&C Position is available.

h. The system shall (DD528) derive the availability status of each system operational function on a continuing basis.

i. The system shall (DD529) determine when each system function is not available.

j. The system shall (DD531) determine when each system function is degraded.

k. The system shall (DD532) determine when each system function is returned to available.

l. The system shall (DD533) derive the subsystem status for each monitored subsystem from the availability of each operational function on a continuing basis.

m. The system shall (DD534) determine for each subsystem when any operational function provided by the subsystem is not available.

n. The system shall (DD535) determine for the subsystem when any operational function provided by the subsystem is degraded.

o. The system shall (DD536) determine for the subsystem when all operational functions of the subsystem are available.

p. The system will not declare alarm/normal conditions for monitored parameters subject to state change determination.

q. The system shall (DD538) perform alarm/normal determination without interfering with or degrading the DS/CP/EDI operational mission, or any other functions of the system/subsystem it is monitoring.

3.2.4.1.2.2.2 State Change Status Determination

The system will provide state change comparisons as part of its status determination. This comparison will determine if the system or one of its subsystems or components has changed to another state.

a. The system shall (DD541) declare a state change event when the configuration of the monitored system or subsystem changes, including loss/re-establishment of communications with the HCS and receipt of HCS-directed startup/startover commands.

b. The system shall (DD542) declare a state change event when the mode of operation of the monitored system or subsystem changes, including when a controller position switches from Host/EDI data path processing to EDARC/EDI data path processing, and vice versa, and when a command is received from the M&C position to enable/disable alarm/normal detection of monitored parameters.

c. The system shall (DD543) not declare state change events for parameters that are monitored for alarm/normal detection.

d. The system shall (DD544) perform state change status determination without interfering with or degrading the EDI operational mission, or any other functions of the system/subsystem it is monitoring.

3.2.4.1.2.3 Data Reporting

The system will report status notifications unsolicited to the M&C position. The system will report/display performance data, subsystem status, and control parameters when requested by the M&C position.

3.2.4.1.2.3.1 Alarm/Return-to-Normal Reporting

a. The system shall (DD548) report/display an alarm, or return-to-normal notification to the M&C position on occurrence when the condition is first declared.

b. The system shall (DD549) include the monitored parameter associated with an alarm condition in an alarm notification.

c. The system shall (DD550) include the monitored parameter associated with a normal condition in a return-to-normal notification.

d. The system shall (DD551) include the date and time that a condition was declared when reporting/displaying an alarm condition.

e. All generated alarm/return-to-normal notifications for the EDI system shall (DD552) be retained in a form which allows on-line operator-selectable retrieval for a period of at least 24 hours.

3.2.4.1.2.3.2 State Change Reporting

a. The system shall (DD555) report/display a state change notification to the M&C position on occurrence when the event is first declared.

b. The system shall (DD556) include the monitored parameter associated with a state change event in a state change notification.

c. The system shall (DD557) include the date and time that an event was declared when reporting a state change notification.

d. All generated state change notifications for the EDI system shall (DD558) be retained in a form which allows on-line operator-selectable retrieval for a period of at least 24 hours.

3.2.4.1.2.3.3 Other Data Reporting

a. The system shall (DD560) report/display specific monitored parameters (i.e., performance data reports) when requested by the EDI M&C position. The system shall (DD561) have the capability to continuously monitor the utilization of system resources. This monitoring shall (DD562) include, but not be limited to, network and network component utilization, processor utilization, input/output peripheral attachment path utilization, peripheral device utilization, processor page faults rates and DASD page space utilization, and utilization of the processor by its resident operating system and software processes.

b. The system shall (DD563) report/display a designated set of monitored parameters (i.e., global performance data report) when requested by the M&C position.

c. The system shall (DD564) report/display the most recently acquired monitored parameters in performance data reports.

d. The system shall (DD565) report/display the most recently determined alarm or normal conditions associated with monitored parameters in performance data reports.

e. The M&C shall (DD566) report/display subsystem status when requested by the M&C position.

f. The M&C shall (DD567) report/display control parameters (e.g., thresholds, timers, counters, etc.) when requested by the M&C position.

g. All reported parameters shall (DD568) be logically grouped according to subsystem structure; i.e., physically segregated hardware, common functions, or conditions with functional and/or physical commonality.

h. Each logical grouping shall (DD569) be uniquely identifiable.

i. Each parameter within a logical grouping shall (DD570) be uniquely identifiable.

3.2.4.1.3 Control Capabilities

3.2.4.1.3.1 Startup

The system shall (DD573) provide a capability at the M&C position to initialize the Host/EDI, CP applications and interfaces, or EDARC/EDI path, individual processors to support air traffic processing.

3.2.4.1.3.2 Restart

The system shall (DD575) provide a capability at the M&C position to restart the Host/EDI or EDARC/EDI path, CP applications and interfaces, one or all individual processors or one or all individual consoles with or without recovery data selected.

The system shall (DD2461) provide a hardware-initiated remote restart capability for all rack-mounted system processors (excluding bridges) and for the PCUs.

The system shall (DD2462) provide this remote restart capability on an individual processor basis.

This remote restart capability shall (DD2463) be located in the vicinity of the M&C position.

3.2.4.1.3.3 Reconfiguration

The system shall (DD579) have the ability to isolate or reconfigure/reassign any component (hardware or software element) to any required operational state or use with a single command.

The system shall (DD3461) provide the capability at the M&C position to isolate or reassign CP components (hardware, software, CP applications and interfaces) to any required operational state with a single command.

3.2.4.1.3.4 Shutdown

The system shall (DD577) provide a capability at the M&C position to terminate air traffic related processing for the Host/EDI or EDARC/EDI path, individual consoles or individual processors.

3.2.4.1.3.4.1 Host/EDI Interface Control

The EDI M&C shall (DD3464) provide in addition to the existing system monitoring and control capabilities/ functions, the capability to monitor and control the EDI Interfaces between CP and neighboring CPs. The EDI M&C positions shall (DD3466) enable/disable the EDI without identifying hardware or software elements that comprise the interface. The system shall distinguish interface status between commanded down (disabled) versus failed down.

3.2.4.1.3.5 EDI Application Control

The system shall (DD3468) provide the capability at the M&C position to terminate/activate CP functionality /processing entirely, or at a D-position, or multiple D-positions.

The CP shall (DD3469) provide a capability in adaptation data to designate individual D-positions as eligible/ineligible (activated/non activated) for CP functionality upon start-up.

3.2.4.1.3.6 Software Loading

The system shall (DD581) provide the capability at the M&C position to control the loading of new software releases to system processors.

3.2.4.1.3.7 Software Cutover

The system shall (DD583) provide the capability at the M&C position to control the cutover of new software releases in system processors, including fallback to prior releases, if necessary.

The system shall (DD3472) provide a capability to ensure that only designated compatible software is allowed to operate on EDI processors.

3.2.4.1.3.8 System Analysis Recording (SAR) Control

The system shall (DD585) provide the capability at the M&C position to control the system analysis recording functions, including initiating and stopping recording, and controlling what data is recorded.

The system shall (DD586) ensure that the SAR retention period for a SAR tape has expired prior to recording new SAR data on the tape.

3.2.4.1.3.9 Detection Control

The system shall (DD588) process commands from the M&C position to enable/disable alarm/normal detection for monitored parameters.

The system shall (DD4334) process commands from the M&C position to enable/disable alarm/normal detection for WARP service status.

3.2.4.1.4 M&C Computer Human Interface (CHI)

3.2.4.1.4.1 Data Entry and Display

All M&C displays shall (DD5591) be presented to the operator in the form of movable, resizeable windows except for COTS non-resizable windows.

The system shall (DD592) provide a set of hierarchical displays to enable the operator to navigate from top-level Graphical/Summary Views (indicating logical to physical relationships) to obtain detailed performance and resource status. One of the top level views shall (DD593) present a concise Graphical/Presentation of the entire system configuration with summary error, performance and status information. Traversal through this hierarchical set of displays shall (DD594) be accomplished via a series of single pointer device selections. No more than 3 levels of displays shall (DD595) be used to support any function.

Based on pointer device selection of a system resource, the system shall (DD597) generate a set of context sensitive menus of available functions/actions to be taken.

The system shall (DD599) prompt the operator if an invalid message has been entered.

Graphical and list information displayed at the M&C position shall (DD600) be displayed using redundant information coding (e.g., color, shapes, auditory coding) to highlight non-normal resource status and non-normal performance.

All M&C displays shall (DD601) be opaque (versus transparent).

3.2.4.1.4.2 Commands

The system shall (DD603) support command composition using a combination of keyboard entries and pointer device selections. Frequently used commands shall (DD604) be selectable via the pointer device. Parameter values derivable from entities visible on the screen shall (DD605) be selectable via the pointer device.

Commands under development shall (DD606) be displayed for operator confirmation prior to execution.

When the system has access to a command parameter value, the system shall (DD607) automatically provide context sensitive default datum as the command parameter.

The system shall (DD608) provide a global commanding capability for selected M&C commands. Global is defined as the capability to command by individual resource, by group, by class, or all resources.

The system shall (DD610) provide the capability for the M&C operator to reset all operator-modifiable system parameters to default, adapted, or initial values.

The system shall (DD611) provide M&C with consistent and standardized command entry such that similar actions are commanded in similar ways.

The system shall (DD612) prevent inadvertent or erroneous actions that can degrade operational capability.

3.2.4.1.4 M&C Computer Human Interface (CHI)

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The system shall (DD611) provide M&C with consistent and standardized command entry such that similar actions are commanded in similar ways.

The system shall (DD612) prevent inadvertent or erroneous actions that can degrade operational capability.

b. All system outputs;

c. All system and component recoveries, and reconfigurations;

d. System status and configuration data including changes;

e. Performance and resource utilization of the system and system components;

f. Significant security events.

3.2.4.3.1 Data Recording

System analysis recording:

a. Shall (DD634) provide the capability to record all selected data while performing all system functions within the performance requirements specified in Section 3.2.5, Performance.

b. Shall (DD635) provide the capability to record for off-line reduction and analysis of system problems and performance as specified in Section 3.4.1.5, Data Reduction Analysis, selected system data including any COTS operating system error logs and dumps.

c. Shall (DD636) provide the capability to periodically record the selected data or automatically dump selected memory areas and internal state information when errors/abnormal conditions are detected.

d. Shall (DD637) provide the capability to select data categories and items to be recorded and the conditions for recording by adaptation and M&C commands.

e. Shall (DD638) provide the capability to record all system recordings on a removable storage media at a single location for a minimum of 8 hours without operator intervention. System recording will be retained off-line for a minimum of 15 days.

f. Shall (DD639) provide the capability to terminate, by M&C command, recording on all recording storage media simultaneously so that off-line analysis of the data stored on that media can be performed and provide the capability for continuing recording without loss of recorded data.

g. Shall (DD640) provide the capability to record site identity, program version number, adaptation identity, and data start/end time on each medium and time-stamp all recorded data.

h. Shall (DD641) provide the capability to record changes in resource monitoring and recording selection parameters.

i. Shall (DD3488) provide the capability to record and retain individual processor initialization/control events prior to the initialization of the system recording function for a period of at least seven minutes following processor initialization. These recorded initialization events shall (DD3489) be transferred to the system recording function upon availability of the system recording function.

j. Shall (DD3490) provide the capability to independently initialize the system recording function upon detection of a power-on condition without direction or control from the M&C capability.

3.2.4.3.2 System Data Reduction and Analysis Capability

The system shall (DD643) provide an ESSC capability for the off-line data reduction of recorded system data for analysis of the system's technical and operational performance as specified in Section 3.4.1.5, Data Reduction and Analysis.

3.2.4.4 Software Load/Cutover/Test

3.2.4.4.1 System Loading

The system shall (DD646) support loading of system software, downloadable firmware and adaptation data.

The system:

a. Shall (DD649) provide the capability to load GEOMAP data and new system software, including operating systems, downloadable firmware, and system adaptation to system processors under the control of the M&C workstation with no disruption to or degradation of on-going system operations or performance, except during firmware upgrades.

b. Shall (DD650) provide the capability to load three complete versions of application software and adaptation and two levels of operating system software in each system processor utilizing it.

c. When software is loaded into a processor, positive verification shall (DD651) be performed to confirm that all software is loaded without corruption, with the results reported to the M&C position, except when restoring EDARC data to R-display positions following a power interruption.

3.2.4.4.2 Cutover

Cutovers of system processors to different versions of software and/or adaptation will be performed utilizing current Host/DS systems procedures. ATC operations will be conducted on one path, Host/EDI or EDARC, while the other path is cutover to a previously loaded version of software and/or adaptation.

At an individual R-Position , it shall (655) be possible to cutover software associated with Host Display Mode processing while performing EDARC Display Mode processing and vice versa.

The system shall (DD656) provide the capability to, under control of the M&C and at M&C command, cutover system processors to a previously loaded version of software and/or adaptation with no effect on the operational path.

3.2.4.4.3 Test

A standalone Test and Training (T&T) subsystem, that is a microcosm of the operational system, will exist at each selected ARTCC. The T&T configuration will support on-site ATC

training on, and testing of, the operational system software. ARTCC system testing will be conducted initially on the non-operational test and training (T&T) system, and then on the Host path of the operational system while operations are conducted on the EDARC path of the operational system (without impacting on-going ATC DS operations). Thus all simulation and analysis capabilities will have to be provided to both environments. The ability to perform end-to-end system testing will be available in both the operational and T&T environments.

The system:

a. Shall (DD3500) provide a T&T system with sufficient resources to functionally replicate the operational system to meet the testing needs.

b. Shall (DD3501) provide an interface between the T&T system and the GFE Host Standby. This interface is for the purpose of receiving messages generated by Host simulation functions executing on the GFE Host Standby.

c. Shall (DD660) provide the capability to test and evaluate software and adaptation versions, analyze performance, and perform problem analysis on the T&T system as well as the operational system.

d. Shall (DD3503) produce all SAR data in the same physical and logical form as currently supported by the Host and ESSC DR&A capability.

e. Shall (DD3504) provide the capability to test DS with CP turned on or off. The capability to turn CP on/off at D-positions is documented in section 3.2.1.1.20.12 ("Additional User Inputs").

f. Shall (DD4207) provide the capability to test DS with CP turned on only at some positions. The capability to turn CP on/off at D-positions is documented in section 3.2.1.1.20.12 ("Additional User Inputs").

g. Shall (DD661) provide the capability to perform system level end-to-end tests utilizing simulated inputs including Host data, interfacility data, and user inputs.

h. Shall (DD3505) provide additional simulation tools necessary to test new functionality added with the CP application.

i. Shall (DD662) provide the capability to perform all system tests with no degradation of on-going ATC operations or system performance.

3.2.4.5 Certification

3.2.4.5.1 LRU Verification

Prior to allowing an off-line LRU to be configured as a part of the on-line operational system, the DS/EDI shall (DD665) automatically initiate comprehensive tests/diagnostics on that off-line LRU (to the extent possible for that LRU), and report the results to the M&C operator.

3.2.4.5.1.1 Periodic Background Verification

The DS/EDI shall (DD667) automatically perform real-time, on-line, periodic tests without interruption or degradation to operations on all LRUs consisting of the following steps, and reporting any out-of-tolerance results to the M&C position:

a. Hardware verification, by initiating a test/diagnostic process to provide a positive verification that each DS/EDI LRU is currently operating without any hardware error or failure indications.

3.2.4.5.1.2 Background Verification Frequency

The system shall (DD669) provide the capability at the M&C position to modify the frequency of these background verification tests, from a minimum frequency of once every 4 hours to a maximum frequency of once every 4 minutes.

3.2.4.5.1.3 Manual Initiation of Background Verification

The system shall (DD671) provide a capability at the M&C position to manually initiate the background verification test for a specified LRU, and receive a hard copy printout of the test results.

3.2.4.5.2 System Certification

3.2.4.5.2.1 On-Line Certification Support

The system shall (DD674) provide on-line system certification of the entire DS/EDI without interruption or degradation to operation.

3.2.4.5.2.2 Manual Certification Initiation

The system shall (DD676) provide a capability at the M&C position to manually initiate, at any time, on-line certification of DS/EDI.

The on-line system certification process shall (DD677) consist of the following steps:

a. Perform a software verification of the software in all DS/EDI LRUs, to include:
   1) Positive verification that the release levels for the software in the "Current" and the "Fallback" slots match those contained in the M&C position on the appropriate path.
   2) Status of any software element known to the availability management function to exist at a state/status lower than normal or available, i.e., down or degraded.
b. Print out a dated and time-stamped report detailing the results of this software verification.
c. Initiate a test/diagnostic process to provide a positive verification that all DS/EDI LRUs are currently operating without any hardware error or failure indications.
d. Print out a dated and time-stamped report detailing the results of this LRU verification, clearly showing which LRUs passed, which LRUs failed, and highlighting any problems, including failure of an LRU to respond.
e. Upon M&C operator request, print out a dated and time-stamped report with detailed diagnostic results for any LRU, which failed one or more diagnostic tests.

f. The System Certification Report shall (DD3521) printout a status of all DS/EDI interfaces as to available, Operational/non-operational, or down.

g. The System Certification Report shall (DD3522) printout a status of all DS hardware elements that cannot be tested by the functions identified in item d and/or e above that are known to the availability management function to be down or degraded.

3.2.4.5.2.3 System Certification Time Allocation

The on-line system certification response time requirement is stated in Section 3.2.5.3.1, System Certification.

3.2.4.5.3 Service Certification Support

The DS shall (DD681) provide the capability to support and participate in the existing Host-based service certification procedures for Composite Radar Data Processing (CRAD), Composite Flight Data Processing (CFAD) and Enhanced Direct Access Radar Channel (EDARC) in accordance with FAA Orders 6000.15B and 6100.1, with no Host procedure modifications required due to the incorporation of the EDI equipment.

3.2.4.6 Air Traffic Training Support

An interactive simulation capability to support Air Traffic operational training shall (DD3527) be provided in the non-operational T & T system. The training simulation function shall (DD3528) provide , at a minimum, the same capabilities as the current DYSIM function. Air Traffic operational training is conducted at unique training sector positions. These training positions are generally located away from operational ATC positions.

To support ATC training the Training System:

a. Shall (DD685) provide the capability to exercise Air Traffic operational training with the CP functionality and CHI turned on or off at any position at the instructors option, and include scenarios involving unplanned CP outages. The capability to turn CP on/off at D-positions is documented in section 3.2.1.1.20.12 ("Additional User Inputs").

b. Shall (DD686) provide the capability to perform such training concurrently with ongoing ATC operations, with no impact to operations. Operational software will be used in training exercises, but its use must never interfere with or jeopardize operational ATC activities.

c. Shall (DD687) provide all data entry, display, flight strip printing capabilities and position equipment included in the Operational System at ATC training positions.

d. Shall (DD688) support training for every operational sector within the facility.

e. Shall (DD4208) provide the capability to run existing DS training scenarios without modification.

3.2.5 Performance

This section specifies the design workload, response time, system function, reserve capacity, and accuracy requirements.

All requirements specified in Section 3.2.5, Performance, will apply to the operational En Route systems at the ARTCC and an SSF at the WJHTC, but not to the stand-alone Test and Training, ESSC, Support, or Academy systems.

3.2.5.1 Design Workload

This section defines the design workload for the Enhanced DSR Infrastructure and Conflict Probe application. The design workload reflects activity at a large center during a peak period in 2005 and is the workload that the system must be capable of processing while satisfying response time, system function time, reserve capacity, and accuracy requirements. Unless otherwise specified, neighboring facilities' workload characteristics are the same as those specified in this section.

The design workload is specified as a collection of numeric attributes. The values of these attributes can either be constants or time-varying. The attributes specified in the Airspace Geographic Characteristics and Maximum System Configuration Parameters tables are constants. All other attributes are time-varying.

Attributes specified as constants indicate the maximum number of the corresponding data items that will occur in the design workload.

When a time-varying attribute of the design workload implies a minimum value, the design workload equals or exceeds the value assigned to that attribute for any moving average of three successive one-minute intervals for a continuous period of at least 30 minutes.

When a time-varying attribute of the design workload implies a maximum limit, the design workload does not exceed the value assigned to that attribute for any moving average of three successive one-minute intervals during the same 30 minute period.

When a time-varying attribute of the design workload implies an average, rate, or expectation, the design workload does not deviate from that value by more than 20 percent, measured relative to the average or expected value of the attribute, for any moving average of six one-minute intervals during the same continuous period of at least 30 minutes and by less than 5 percent over the continuous period.

3.2.5.1.1 Airspace Characteristics

The airspace is described in terms of number and size of geographic objects, aircraft trajectories, and the adherence of aircraft to their ATC Clearance. The nominal Center Area is 500X500 nautical miles (nm). The ADP Boundary extension beyond the Center Area is 200 nm.

3.2.5.1.1.1 Geographic

Table 3.2-1 contains the airspace geographic characteristics for the design workload. In addition to the items listed in the table, altitude and other restrictions typically found in Center airspace are included in the design workload.

Table 3.2-1: Airspace Geographic Characteristics

Item	Value/ Maximum Number
Airports within Center	540
Sectors within Center	65
Unique Fixes within Center	8000
Airways within Center	750
Preferential Routes (PDR, PAR, PDAR, SID, STAR) within Center	7850
Special Activities Airspaces	150
Standard Separation Volumes	50
APDIAs/Tactical Airspaces within Center	40
Fix Posting Areas	175

3.2.5.1.1.2 Trajectory Characteristics

For the purposes of this specification, an aircraft is considered to be at an altitude or flight level[1] when its reported altitude is within 500 feet of the altitude or flight level when below FL 290 and within 1000 feet of the flight level otherwise[2].

3.2.5.1.1.2.1 Airspace Density

The active tracks in the design workload are distributed among altitude and flight levels up to and including FL 450. FL's 310, 330, and 350 each contain 9% of the total active track load. The active track load averages at other altitudes are equal with a standard deviation of 1%.

The closest-point-of-approach (CPA) is the distance between a controlled track and the nearest track or Special Activities Airspace within the same altitude or flight level. CPA is only computed when the routes of flight of an aircraft pair at the same altitude or flight level overlap both time and longitude[3]. CPA between an aircraft and the edge of a Special Activities Airspace is only computed when the aircraft's route of flight and airspace overlap in longitude. In the design workload, using these criteria, CPA is computed for a minimum of: (1) 2% plus 0.13% per 100 feet of altitude of active tracks at altitude levels up to 10,000 feet Mean Sea Level (MSL); (2) 27% of active tracks between FL 280 and FL 370, inclusive; and (3) 11% of active tracks at all other altitude and flight levels.

Table 3.2-2 contains the maximum average and minimum standard deviation of CPA by altitude and flight level for the cases when CPA is computed in the design workload. Altitude-

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[1] A flight level is a pressure-determined altitude.

[2] Aircraft performing vertical maneuvers are included in this definition.

[3] It should be noted that the Airspace Density table is independent of the overlap of aircraft trajectories in terms of latitude.

based linear interpolation[4] is used to determine these parameters for altitudes and flight levels between those listed in the table.

Table 3.2-2: Airspace Density

Altitude	Maximum Average CPA (nm)	Minimum Standard Deviation of CPA (nm)
FL 450	16	2
FL 350	100	72
Between FL 100 and FL 250	30	8
1000 feet MSL	1	1

3.2.5.1.1.2.2 Aircraft Maneuvers

Table 3.2-3 contains the percentage of controlled tracks flying at their assigned altitudes that perform turn maneuvers in the design workload. Table 3.2-4 contains the percentage of tracks performing ascent maneuvers by altitude/flight level.

Table 3.2-5 contains the percentage of tracks performing descent maneuvers by altitude/flight level.

In these tables, *small turns* are those that result in a difference between initial and final course of less than 130 degrees. Turns that result in a difference between initial and final course of at least 130 degrees are *large turns*[5].

Table 3.2-6 contains the mean and standard deviation of aircraft groundspeed by altitude/flight level. Altitude-based linear interpolation is used to determine parameters for altitudes and flight levels between those listed in the tables.

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[4] Given two altitude or flight levels in the table, a1 and a3, and the corresponding CPA parameters (average or standard deviation), c1 and c3, the value for some other level a2, where a1<a2<a3, is computed using altitude based linear interpolation at c1 + (a2-a1)*{(c3-c1)/(a3-a1)}. For the purposes of altitude based linear interpolation, 18,000 feet MSL may be considered equal to FL 180.

[5] Operationally, large turns are defined to be those maneuvers that cause the Host Computer System (HCS) Table TK track maneuver status to be set to LTURN. Similarly, small turns are defined to be those maneuvers that cause the track maneuver status to be set to STURN.

Table 3.2-3: Turns by Aircraft Flying at Assigned Altitude/Flight Level

Altitude	Small Turn	Large Turn
Above FL 350	2.5%	0.15%
Between 10,000 feet MSL and FL 350	33% minus (0.09% per 100 feet of altitude)	0.15%
Below 10,000 feet MSL	33% minus (0.09% per 100 feet of altitude)	33% minus (0.32% per 100 feet of altitude)

Table 3.2-4: Ascent Maneuvers by Altitude/Flight Level

Altitude	Climb without Turning	Climb and Small Turn	Climb and Large Turn	Total
FL 450	0%	0%	0%	0.0%
FL 440	5%	0.5%	0%	5.5%
FL 350	5%	1%	0%	6.0%
FL 270	25%	2.5%	0%	27.5%
FL 210	25%	5%	0%	30.0%
14,000 feet MSL	25%	5%	0%	30.0%
1000 feet MSL	1%	0%	1.5%	2.5%

Table 3.2-5: Descent Maneuvers by Altitude/Flight Level

Altitude	Descend without Turning	Descend and Small Turn	Descend and Large Turn	Total
FL 450	6%	0%	0%	6.0%
FL 400	2.5%	0%	0%	2.5%
FL 310	8%	1%	0%	9.0%
FL 260	25%	2.5%	0%	27.5%
14,000 feet MSL	25%	5%	0%	30.0%
5000 feet MSL	25%	17%	0%	42.0%
1000 feet MSL	42.5%	35%	20%	97.5%

Table 3.2-6: Aircraft Groundspeed by Altitude/Flight Level

Altitude	Mean Velocity (knots)	Standard Deviation of Velocity (knots)
FL 450	420	20
FL 350	450	40
FL 270	400	100
15,000 feet MSL	275	80
5000 feet MSL	200	50
1000 feet MSL	150	2

3.2.5.1.1.2.3 Track Type

Track type describes the source and destination of controlled tracks. An *Arrival* is a track that was controlled by an adjacent NAS or external ARTS before the current Center or local ARTS assumed control and whose associated flight will be landing within the Center boundary. A *Departure* is a track whose associated flight departed from within the local Center boundary and control subsequently passed to an adjacent NAS or external ARTS. An *Over* is a track controlled by an adjacent NAS or external ARTS both before and after center control. All other controlled tracks are called *Within.*

3.2.5.1.1.2.4 Deviation from ATC Clearance

Algorithm accuracy requirements defined in Section 3.2.5.5.2, Conflict Probe Accuracy are limited to tracks that are (1) in lateral adherence with their ATC Clearance; and (2) within 300 feet of their assigned altitude or flight levels below and within 600 feet at or above FL 290 except when performing vertical maneuvers. Table 3.2-7 contains the maximum percentage tracks, by altitude block, that deviate laterally from their ATC Clearance in the design workload[6].

Table 3.2-7: Deviations from ATC Clearance

Altitude	Percent Not In Adherence
Above 10,000 feet MSL	2.5%
Between 4000 and 10,000 feet MSL	6%
Below 4000 feet MSL	15%

3.2.5.1.2 System Configuration Parameters

Maximum system configuration parameter values are presented in Table 3.2-8.

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[6] Operationally, deviations from ATC Clearance are defined as maneuvers that cause the Host Computer System (HCS) Table TK track association status to be set to OUTLAT.

Table 3.2-8: Maximum System Configuration Parameters

Sources and Destinations	Maximum Design Configuration
Surveillance Sites	25
R-Position	90
D-Position	70
A-Position	35
M&C-C Sub-Position	1
M&C-H Sub-Position	3
M&C-E Sub-Position	3

3.2.5.1.3 Rates of Events

This section describes the rate at which events occur that trigger computation.

3.2.5.1.3.1 Key Workload Parameters

Table 3.2-9 lists the values to be used for the key parameters that determine the rate at which events triggering computation occur in the design workload.

Table 3.2-9: Key Workload Parameters

Variable	Symbol	Value	Unit
Active Tracks	N	540	tracks
DYSIM Training Tracks	Y	100	tracks
Controlled Tracks	C	432=0.8*N	tracks
Uncontrolled Tracks	U	528	tracks
Fraction of Tracks Representing Military Formations		0.02	dimensionless
Average Track Life in Center	T	23.6	minutes
New Controlled Tracks per Minute	Rcy	18.3=C/T	tracks/minute
New Controlled Tracks per Minute less DYSIM	R	14.1=(C-Y)/T	tracks/minute
Flight Distribution			
- Fraction Arrivals	A	0.293	dimensionless
- Fraction Departures	D	0.403	dimensionless
- Fraction Over	O	0.179	dimensionless
- Fraction Within	W	0.125	dimensionless
Ratio of APD Zone to Center Aircraft	Z	2.24	dimensionless
Fraction of Aircraft in APD Zone Entering or Leaving Center	X	0.46=(A+D+2*O) /Z	dimensionless
Fraction of Center Airspace Volume within Active APDIAs/Tactical Airspaces		0.20	dimensionless
Average Number of Affected Centers per Controlled Track	F	2.24	centers
Average Sectors Penetrated per Controlled Track		3.7	sectors
Average Track Life in Sector	K	6.3	minutes
Interim Altitudes per Controlled Track	J	2	altitudes
Amendments per Controlled Track	M	3.2	amendments
Radar Scan	S	11	seconds
Host Cycle	H	6	seconds
Converted Route Segments in Center		25	segments/flight
Current Plans within Center		1814=4.2*C	plans
Current Plans within Center less DYSIM		1394=4.2*(C-Y)	Plans
Current Plans in APD Zone		744=Z*(C-Y)	plans
Trial Plan Life		2	minutes
Flights in Auto-Replan		43=C/10	flights
Flights in Auto Replan less DYSIM		33=(C-Y)/10	flights
Altitude/speed Restrictions within Center		220	restrictions

3.2.5.1.3.2 Surveillance Updates

Table 3.2-10 gives minimum rates for surveillance data updates in the design workload.

Table 3.2-10: Surveillance Data Update Rates

Data Type	Derivation	Rate per Second
Full Data Blocks	(0.75*2.53*N)/H	171
Limited Data Blocks	(N+2*U)/S	145
Line Data		
- Halo	empirical	1
- Misc.	empirical	0.4
Radar Data		
- Primary	empirical	86
- Beacon	(N+U)/S	97
Weather Data		
- Lines	empirical	18
- Symbols	empirical	18

3.2.5.1.3.3 Input Actions

The minimum input rate for commands from R-Positions is 9.2 (=2+8*N/600) per second in the design workload. Table 3.2-11 contains the distribution of these commands by type.

Table 3.2-11: Basic R-Position Command Distribution

Data Type	Percentage
Interim Altitude	0.46%
Track	1.46%
Track Reroute	0.20%
Assign Altitude	2.83%
Cancel Interim Altitude	0.40%
Input of (1) Quick Action: (2) Category and Function: (3) Quick-Look: or (4) See-All evenly distributed	10.9%
Input of (1) change of range scale at one console: (2) change in display center at one console: (3) selection of a Class/Type at 4% of consoles: (4) deselection of beacon radar at 4% of consoles: or (5) increase in radar history at 4% of consoles evenly distributed	10.9%
Other Inputs	Residual

The minimum input rate for commands from the D-Position is 2.9(=3.2*N/600) commands per second in the design workload[7]. These commands are distributed as shown in Table 3.2-12.

[7] Input action scaling is not adjusted for DYSIM Training Tracks (Y) since DSR training does not separate DYSIM tracks from other controlled tracks.

Table 3.2-12: Basic D-Position Command Distribution

Data Type	Percentage
Flight Plan Amendments	
Altitude	24.04%
Route	6.19%
Speed	2.87%
Other	0.69%
Other Inputs	Residual

Table 3.2-13 lists minimum rates for commands in the design workload, beyond the basic commands described above, to be entered from the D-Position.

Table 3.2-13: Supplementary D-Position Command Rates

Data Type	Derivation (with DYSIM)	Rate per Minute	Derivation (without DYSIM)	Rate per Minute
Create Trial Plan	0.75*M* Rcy	44	0.75*M* R	34
Resubmit Trial Plan	0.25*0.75*M* Rcy	11	0.25*0.75*M* R	8
Auto Coordination (Initiate and Respond)	0.2*0.75*M*X*Z*Rcy	9	0.2*0.75*M*X*Z*R	7
Automated Replan Submission Rate	(C/10)/10	4.3	((C-Y)/10)/10	3.3
Additional Interim Altitude Commands[8]	J*Rcy -60*0.0059*7.2	34	J*R -60*0.0059*7.2	26
GPD Display Control Action[9,10]	estimate	325	estimate	325
Remove List Entry	estimate	96	estimate	96

The data presented in Table 3.2-14 specify the rate of input actions from the M&C position controlling either the Host/EDI path or the EDARC/EDI path in the design workload.

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[8] These commands represent current verbal Interim Altitude assignments, which must be entered into the automation system to support CP.

[9] A GPD Display Control Action is any controller input that causes a change in the GPD.

[10] Changes to the setting of the Future Time control of the GPD account for 1.3 percent of all GPD Display Control Actions.

Table 3.2-14: M&C-H or M&C-E Position Command Activities

Command Action	Minimum Rate
Display Manipulation (e.g. Suppress, resize)	4 per minute
Request and Display a View	2 per minute
Assignment of Consoles/Positions to Operational Status[1]	2 per minute
Removal of Console/Positions from Operational Status[1]	2 per minute
Query of Alert History Log	1 per 3 minutes
Item selected via CPSD for Cmd Composition	20 per minute

[1] These actions may be applied to non-controlling positions. Specified rate applies for three distinct 2-minute periods per hour.

3.2.5.1.3.4 Weather Update Messages

Minimum WARP product transmission rates in the design workload are listed in Table 3.2-15. In the design workload, successive wind and temperature reports will vary by at most 29 degrees in wind direction, 19 knots in wind speed, and 4 degrees Centigrade in temperature at any reporting point.

Table 3.2-15: WARP Product Transmission Rates

Product Name	Maximum Product Size	Rate
WARP Layer Composite Reflectivity Mosaic (Super High Layer)	13312 bytes	144/hr.
WARP Layer Composite Reflectivity Mosaic (High Layer)	27648 bytes	144/hr.
WARP Layer Composite Reflectivity Mosaic (Low Layer)	51200 bytes	144/hr.
WARP Layer Composite Reflectivity Mosaic (Combined Layers)	51200 bytes	144/hr.
NEXRAD Coverage Map	10240 bytes	144/hr.
Winds and temperatures aloft, barometric pressure	5 Mbytes	1/hr.

3.2.5.1.3.5 Additional Host Message Rates

In addition to messages resultant from the input actions described in Section 3.2.5.1.3.3, Input Actions, the Host will send to CP the messages at the rates described in Table 3.2-16 in the design workload.

Table 3.2-16: Additional Host Message Rates

Message	Derivation (with DYSIM)	Rate per Minute	Derivation (without DYSIM)	Rate per Minute
Flight Plan				
- Proposed	(D+W)*Rcy	9.7	(D+W)*R	7.4
- Active	(O+A)*Rcy	8.7	(O+A)*R	6.7
Departure Message	(D+W)*Rcy	9.7	(D+W)*R	7.4
Cancellation	0.3*Rcy	5.5	0.3*R	4.2
Track Updates	N*(60/(2*H))	2700	(N-Y)* (60/(2*H))	2200
Drop Track	0.3*Rcy	5.5	0.3*R	4.2

The Host will also send to the EDI messages specified in the Common Message Set IRD that CP will not process. The minimum Host to EDI message rate for messages in the Common Message Set that do not require CP processing is TBD messages per minute in the design workload. The average size of these messages is TBD bytes.

3.2.5.1.3.6 CP Steady-State Interfacility Update Messages

Table 3.2-17 contains the minimum steady-state interfacility message input rate required to support CP in the design workload. Table 3.2-18 contains the minimum steady-state interfacility message output rate required to support CP in the design workload. These tables do not include non-ATC messages nor messages required for startup/startover/error recovery.

Table 3.2-17: Interfacility Input Message Rate

Message	Derivation	Rate / Minute
Current Plan	(A+O+(1-X)*Z)*R	24
Current Plan Responsibility Change Notification	(Z+1)*(D+O)*R	26
Amendment	M*Z*R	101
Interim Altitude Assignment	J*Z*R	63
Current Plan Deletion	(D+O+(1-X)*Z)*R	25
Facility/Sector Ownership Change	Z*(T/K)*R	118
Track History	(A+O)*R	7
Initiate Current Plan Transfer	(D+O)*R	8
Current Plan Transfer Acknowledge	(A+O)*R	7
Automatic Problem Detection Eligibility	Z*R	32
Automated Coordination (Initiate and Respond)	0.1*0.2*0.75*M*X*Z*R	0.7

Table 3.2-18: Interfacility Output Message Rate

Message	Derivation	Rate / Minute
Current Plan	F*(D+W)*R	17
Current Plan Responsibility Change Notification	F*(A+O)*R	15
Amendment	F*M*R	101
Interim Altitude Assignment	F*J*R	63
Current Plan Deletion	F*(A+W)*R	13
Facility/Sector Ownership Change	F*(T/K)*R	118
Initiate Current Plan Transfer	(A+O)*R	7
Current Plan Transfer Acknowledge	(D+O)*R	8
Track History	(D+O)*R	8
Automatic Problem Detection Eligibility	F*R	32
Automated Coordination (Initiate and Respond)	0.1*0.2*0.75*M*X*Z*R	0.7

3.2.5.1.4 Display Loads

Display loads are presented for minimum simultaneous display of all data items. The minimum simultaneous loads are to be displayed at a minimum of two sectors in the design workload. The remaining sectors are to display at least 55% of the minimum simultaneous load.

3.2.5.1.4.1 R-Position Display Loads

Design workload minimum display requirements for simultaneous item display at R-Positions is shown in Table 3.2-19.

Table 3.2-19: R-Position Minimum Simultaneous Display

Display Item	Minimum Simultaneous Count	Remarks
Full Data Blocks	45	21 Alphanumeric (Avg.)
Limited Data Blocks	320	7 Alphanumeric (Avg.)
Tabular Data	1025	Characters
Line Data		
Weather Lines	600	Lines
Map Lines	900	Lines
Distance Reference		
Indicator	12	Circular Halo
Misc. Lines	10	Lines
Single Symbol Data		
Weather	200	Single Symbols
Geographic Map	180	Single Symbols
Weather Areas*	1200	Rectangular Strips**
Radar Target Data		
Present:		
Primary	500	Single Symbols
Beacon	475	Single Symbols
History (5 returns)		
Primary	2500	Single Symbols
Beacon	2375	Single Symbols

3.2.5.1.4.2 D-Position Display Loads

The following displays are simultaneously displayed at the D-Position in the design workload: (1) Aircraft List; (2) Plans Display; (3) Graphic Plan Display; (4) Wind Grid Display; (5) Response Display; and (6) Computer Readout Logical Display-MCA; (7) CRLD-UA; and, (8) Departure List.

The minimum size of the sum of the Aircraft List and Departure List during simultaneous display in the design workload is at least 32 (={(K+15+1)/K} *(C-Y)/{2+0.55*63}) single 80 character lines at two sectors and at least 18 (=32*0.55) in the remaining sectors. The Aircraft List update rate is determined by controller and system actions.

The minimum size of the Plans Display List during simultaneous display in the design workload is 16 three-line entries each of which contains 60 characters. The Plans Display update rate is determined by controller and system actions.

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* Assume either weather areas or weather lines and symbols are displayed (whichever imposes the greater load on the display generation equipment), but not both.

** Horizontal strips, .20 inch vertically, 1.1 inch (average) horizontally.

The minimum size of the Graphic Plan Display during simultaneous display in the design workload is listed in Table 3.2-20. The Graphic Plan Display update rate is determined by controller and system actions.

Table 3.2-20: Graphic Plan Requirements Minimum Simultaneous Display

Display Item	Minimum Simultaneous Count	Remarks
Data Blocks	90	21 Alphanumeric (Avg.) plus position symbols, leader line, velocity vector
Lines		
- Route	40	Lines
- Map	1800	Lines
Map Single Symbols	360	Symbols
Labels	365	

The minimum size of the Response Display during simultaneous display in the design workload is three lines each of which contains 80 characters. The response display update rate is determined by controller and system actions.

The minimum size of the Wind Grid Display during simultaneous display in the design workload is listed in Table 3.2-21.

Table 3.2-21: Wind Grid Display Minimum Simultaneous Display

Display Item	Minimum Simultaneous Count
Vectors	81
Wind Values	81
Map Lines	500
Map Single Symbols	270
Labels for Fixes	270

3.2.5.1.4.3 M&C Position Display Loads

Ten (10) simultaneous views are displayed on a single M&C workstation, with no restrictions as to content, in the design workload.

The minimum display update frequencies for M&C Position displays in the design workload are given in Table 3.2-22.

Table 3.2-22: Minimum Frequencies for M&C Display Updates

Display Function	Display Update Type	Minimum Update Frequency
System Status	Dynamic	4 per minute
Operational Functions Status	Dynamic	per status change
Control Room Configuration/Status	Dynamic	10% of the display objects updated each 6 seconds
List of Alerts/Status Change Notifications	Dynamic	15 per minute
Display/Alert History Log Query Results	Static	None
Command Preparation Display	Dynamic	per keyboard entry
Graphic Performance Display	Dynamic	as performance data is received
Control Parameters Report	Dynamic	per parameter change
System Certification Display	Static	none
Individual LRU Certification Display	Dynamic	none

3.2.5.1.4.4 CRLD Output and Tabular List Display Loads

The CRLD Output and Tabular List requirements in the design workload are listed in Table 3.2-23.

Table 3.2-23: CRLD Output and Tabular List Requirements

Position	Message Size	Frequency
R/CRLD	100 Characters	5 per minute
R/CRLD	275 Characters	1 per minute
D/CRLD	100 Characters	5 per minute
D/CRLD	225 Characters	1 per minute
A/CRLD	75 Characters	0.25 per minute
R/Tabular	100 Characters	814 per minute

3.2.5.2 Response Times

3.2.5.2.1 Response Time Definitions

The two measures of response time applicable to ATC critical functions are the Mean and 99th Percentile. They are defined as follows:

a. Mean: The arithmetic average of the response times.

b. 99th Percentile: Only 1 percent of the message responses exceed the value of the 99th percentile.

The two measures of response time applicable to ATC essential functions are the Mean and 95th Percentile. The 95th percentile response time is defined to be:

a. 95th Percentile: Only 5 percent of the message responses exceed the value of the 95th percentile.

3.2.5.2.1.1 Response Time for Unsolicited Data Sent to Controller Positions

This section specifies response times for data received from external systems (e.g., Host, EDARC, WARP) or neighboring facilities that result in updates to controller position displays. The data sent to the displays are not direct responses to commands input from the controller positions receiving the data. The following definition applies to all display outputs generated from processing the data received from external systems.

Two events define the timeline for unsolicited data arriving from external systems or neighboring facilities:

t_1: the time of arrival of data at the EDI system interface to the external system or neighboring facility.

t_2: the time when an output resulting from processing the data appears on a local display.

The response time for unsolicited data generated by external systems or neighboring facilities is defined to be the time interval (t_2-t_1).

3.2.5.2.1.2 Response Time for Input Messages

There are two types of responses defined for input messages entered from controller positions or M&C sub-positions: lexical response and semantic response.

Two events define the timeline for lexical responses:

t_1: the time of input device activation (e.g., key depression, trackball select).

t_2: the time the system acknowledges the input (e.g., symbol presentation in a preview area, highlighting of selected symbol)

The lexical response time is defined to be the time interval (t_2-t_1).

Two events define the timeline for semantic responses to input messages that require no processing by external systems (e.g., Host, EDARC) or neighboring facilities:

t_1: the time the input message is entered into the system.

t_4: the time when the last output that results from processing the input message is displayed on a local display or transmitted to a neighboring facility.

The semantic response time for input messages that require no processing by external systems or neighboring facilities is defined to be the time interval (t_4-t_1).

Two additional events define the timeline for messages that require processing by external systems:

t_2: the time the message is sent from the EDI interface to the external system.

t_3: the time the response arrives at the EDI interface from the external system.

The semantic response time for input messages that require processing by external systems is defined to be $(t_2-t_1) + (t_4-t_3)$.

Two events define the timeline for input messages that require processing by neighboring facilities:

t_1: the time the input message is entered into the system.

t_2: the time when the last output that results from processing the input message is displayed at the entering position.

The semantic response time for input messages that require processing by neighboring facilities is defined to be (t_2-t_1). The mean round trip response time for GFE communications will not exceed 0.75 seconds. The 95th percentile round trip response time for GFE communications will not exceed 3 seconds.

3.2.5.2.2 Response Time Values

The system response times for unsolicited data sent to controller positions shall (DD3611) not exceed the values specified in Table 3.2-24 while the system is processing workloads up to and including the design workload specified in Section 3.2.5.1, Design Workload.

The system response times for messages entered at controller positions and M&C sub-positions shall (DD3613) not exceed the values specified in Table 3.2-25 while the system is processing workloads up to and including the design workload specified in Section 3.2.5.1, Design Workload.

All R-position response time requirements shall (DD**) be met even when CP workloads exceed the design workload.

All D-position response time requirements for commands and data that affect the CRLD-MCA, CRLD-UA, Time, and Display Control views shall (DD**) be met even when CP workloads exceed the design workload.

Processors undergoing reconfiguration and recovery, positions being assigned to or removed from operational status, processors performing system functions defined in Section 3.2.5.3, System Function Times, or system initialization, shutdown, restart, or software cutover are exempted from the response time requirements.

Table 3.2-24: Response Time Values (seconds) for Unsolicited Data Sent to Controller Positions

External System Source	Destination	Type of data	Mean	95th Percentile	99th Percentile
Host	R-Position	Target data, full data blocks, limited data blocks, tabular data, aircraft routes	1		1.5
Host	R-Position	Weather lines, weather single symbols, map lines, geographic map and emergency airport symbols			5.5
Host	R-Position D-Position CRLD View	All other data All data	1.25		2
Host	D-Position CP Views	All data	5	10	
Neighboring Facility	D-Position CP Views	All data	5	10	
EDARC	R-Position	Target data, full data blocks, limited data blocks, tabular data, aircraft routes	1		1.5
EDARC	R-Position	Weather lines, weather single symbols, map lines, geographic map and emergency airport symbols			5.5
EDARC	Controller Position	All other data	1.25		2
WARP	R-Position	Precipitation-related data in Table 3.2-15			15
WARP	D-position	Winds, temperature, pressure data in Table 3.2-15		300	

Table 3.2-25: Response Time Values (seconds) for Responses to Input Messages

Entry Position	External System Processing	Type of response or type of input message for which response time applies	Mean (sec)	95th Percentile	99th Percentile
R-Position, M&C-C, M&C-E		Lexical response	0.05		0.1
D/A-Position, M&C-H		Lexical response	0.1		0.15
R-position	Host	Messages affecting position or content of a data block	1.25		1.75
Controller positions	Host	All other messages affecting Display System Views	1.75		2.25
R-position	EDARC	Messages affecting position or content of a data block	1.25		1.75
Controller positions	EDARC	All other messages affecting Display System Views	1.75		2.25
R-position, M&C-C		Display actions/manipulations[1] Quick Look	0.6		1.2
R-position, M&C-C		See-All	1.5		3
Controller positions		All other messages affecting Display System Views	3		5
D-position		GPD display actions/manipulations	3	6	
D-position		All other display actions	0.6	1.2	
D-position		All CP commands	3	6	
M&C-H, M&C-E		All commands[2]	3		5

[1] Includes all display selection and control actions specified in Section 3.2.3.1.1.4, Display Control.

[2] Exclusive of any commands that initiate System Functions specified in Section 3.2.5.3, System Function Times.

3.2.5.3 System Function Times

This section specifies the timing requirements for system functions that may be initiated manually or automatically. The system function time requirements must be met while processing the design workload in one of two configurations. The characteristics of the *maximum system configuration* are defined in the design workload tables. The *49 sector configuration* differs from the maximum system configuration in that it consists of 49 sectors, 52 R-positions, 52 D-positions and 25 A-positions. Unless otherwise specified, the system shall (DD3619) satisfy system function times while processing the design workload in the 49 sector configuration.

3.2.5.3.1 System Certification

The on-line system certification process for all system assemblies shall (DD3621) not exceed 5 minutes from manual initiation until pass/fail summary information is printed (assuming that a printer is available) and is available to the M&C operator on-screen.

3.2.5.3.2 Error Reporting

The system shall (DD3623) provide indications of alarm, alert, return-to-normal, state change, and overall subsystem status conditions within an average of 4 seconds and a 99th percentile time of 8 seconds while processing the design workload in the maximum system configuration. The function time is measured from the time that the system detected the condition to the time that the system provides the indication to the M&C operator.

At least 99 percent of the time intervals between successive reports of performance data to the M&C shall (DD4295) fall within the range of 54-66 seconds while processing the design workload in the maximum system configuration.

3.2.5.3.3 System Reset Time

The time to command a reset to those services defined in Sections 3.2.2, 3.2.3, and 3.2.4, excluding those functions supporting the CP application, shall (DD3628) not exceed 15 minutes.

After a power interruption, the time to restore those services defined in Sections 3.2.2, 3.2.3, and 3.2.4, excluding those functions supporting the CP application, shall (DD3629) not exceed 15 minutes.

The time to display EDARC data at all R-Position displays following a power interruption shall (DD3630) not exceed 4 minutes.

While processing the design workload in the maximum system configuration, the system shall (DD3631) display at the required D-Positions all aircraft list and conflict data derived from flight data received from the collocated Host within 25 minutes after restoration of power following an interruption. This time excludes any delay spent waiting for entry of manual commands required to reset CP and manual commands required to initiate data reconstitution with external data sources.

While processing the design workload in the maximum system configuration, the system shall (DD4304) (1) display at the required D-Positions all aircraft list and conflict data derived from flight data received for the collocated Host and from neighboring facilities and (2) send the data that neighboring facilities require to reconstitute their CP aircraft lists and conflicts within 35 minutes after restoration of power following an interruption. This time excludes any delay spent waiting for entry of manual commands required to reset CP and manual commands required to initiate data reconstitution with external data sources. This time excludes that portion of interfacility GFE communications delays that exceed those identified in Section 3.2.5.2.1 for input message semantic response times.

3.2.5.4 Reserve Capacity and Loading Constraints

This section specifies the hardware capacities that are being reserved to process future En Route system functional enhancements and their associated workloads.

The system's resource utilizations shall (DD3633) be less than or equal to the hardware utilization reserve capacity requirements, as described below, during any 6 minute measurement interval while processing workloads up to and including the design workload.

In each 12 second interval sampled over a continuous 30 minute period while processing workloads up to and including the design workload, the hardware utilizations for resources

that process, store, transmit, display, or record: (1) target data or data derived from target data or (2) monitor and control information shall (DD4178) not exceed the values specified below.

Processors undergoing reconfiguration, recovery, certification, initialization, shutdown, restart, download, or software cutover and positions being reassigned to or removed from operational status are exempted from the 12-second measurement interval reserve capacity requirements.

3.2.5.4.1 Processor

The utilization of any processor that directly interfaces to the Host or EDARC and processes radar target data shall (DD3635) not exceed 70%.

The utilization of any processor that interfaces the Host to Flight Strip Printers shall (DD4179) not exceed 70%.

The utilization of any R-position processor used to convert digital text and graphics to images on the display surface shall (DD3636) not exceed 70%.

The utilization of the R-position processor on the EDARC path shall (DD4344) be less than or equal to 40 percent

The utilization of any processors that manage and format data for the D-positions shall (DD4180) not exceed 50%.

The utilization of processors that perform the SAR recording function shall (DD4302) not exceed 45%.

The utilization of any processors that perform common application services shall (DD3637) not exceed 35%. These common services include, but are not limited to, State Change recording, managing and formatting display data for the R-positions, data interface between the Host and CP, data interface between neighboring facilities and CP, and managing and maintaining flight data.

The software that manages and formats the CP weather data and provides the interface to the WARP external system shall (DD4296) not utilize more than 35% of its host processor.

The utilization of all other processors shall (DD3638) not exceed 50%.

3.2.5.4.2 Primary Storage

Except for processors, directly interfacing to EDARC and the R-positions' common display generators, all processors' memory capacities shall (DD3640) be capable of being increased by 100% without replacing the deployed memory.

For each DS processor, except for those directly interfacing to EDARC, that performs centralized functions on the EDARC path or is classified as an EDARC path "operational" (non EDDC/support) R-position processor and its associated image conversion processor, no more than 55 percent of the initially deployed primary storage capacity shall (DD4345) be required to meet response time requirements specified in Section 3.2.5.2, Response Times.

3.2.5.4.3 Secondary Storage

For any DS processor, no more than 70% of its associated secondary storage capacity shall (DD3642) be required to meet simultaneously the data and program loading requirements

specified in Section 3.2.4.4.1, System Loading, and the response time requirements specified in Section 3.2.5.2, Response Times, and Section 3.2.4.1.2, Monitoring Capabilities.

For any non-DS processor, no more than half of its association secondary storage capacity shall be required to meet simultaneously the data and program loading requirements specified in Section 3.2.5.2, Response Times, and Section 3.2.4.1.2, Monitoring Capabilities.

For secondary storage devices used by operational software to retrieve data, the percentage of time they are utilized transferring data shall (DD3643) not exceed 15%.

3.2.5.4.4 Networks and Communications Channels

A communication channel connects two processing nodes. A network connects more than two processing nodes.

The utilization of any EDARC path network employing collision detection that is used to transmit data to or from R-positions shall (DD3646) not exceed 26%.

The utilization of any token passing-based network on the Host path that is used to transmit data to or from R-positions shall (DD3647) not exceed 45%.

Network data traffic needed to sustain the CP application shall (DD3649) not use more than 15% of any switched CSMA/CD-based or token passing-based network.

Network data traffic needed to sustain the CP application shall (DD3650) not use more than 5% of any non-switched CSMA/CD-based network.

The utilization of all other networks shall (DD4300) not exceed 25%.

3.2.5.4.4.1 Communications Channels

The utilization of any non-DS communication channel or any channel replacing a DS communication channel shall be less than or equal to 35%.

3.2.5.4.4.2 NADIN PSN Loading Constraint

The CP-to-CP load imposed on the NADIN Packet Switched Network (PSN) shall (DD3656) not exceed 50 kilobits per second incoming from the PSN simultaneous with 50 kilobits per second outgoing to the PSN.

The utilization of a CP-to-CP NADIN Packet Switched Network link that supports bi-directional data transmission at a rate of 56 kilobits per second per direction shall (DD**) not exceed 90% in either direction while the system is concurrently processing the design workload and reconstituting with neighboring facilities after a service failure.

3.2.5.5 Accuracy Requirements

3.2.5.5.1 System Timing Data Accuracy

The system time source shall (DD813) maintain synchronization within 2.5 milliseconds to the last received update to the Host system time.

Maximum skew in system time distributed within the system shall (DD814) be limited to one of the following:

a. Two milliseconds, or

b. Twenty milliseconds if additional means beyond time-stamping are provided to facilitate associating related events in different processors.

3.2.5.5.2 Conflict Probe Accuracy

This section defines the algorithm accuracy requirements for Conflict Probe (CP). To determine compliance with the algorithm accuracy requirements, the following definitions will be used:

a. A flight plan is said to be *current* if it is the basis of a Current Plan trajectory.

b. A flight plan is said to be *trial* if it is the basis of a Trial Plan trajectory.

c. The *planning-horizon* is the interval between a time, t, and an instant t+13 minutes in the future. For a current plan, t equals the current instant in time. For trial plans, t is the current instant in time plus 10 minutes. If an aircraft's ATC Clearance is changed and that change has not been determined to be conflict free through trial planning, the time t for that aircraft is reset to the time of the change.

d. A *conflict* is a violation of separation standards between an aircraft and another aircraft or a Special Activities Airspace.

e. An *alert* is an output from CP displayed at one or more controller positions predicting a conflict based on the current airspace situation and changes in that situation predicted using current and trial flight plans.

f. *Warning time* is the interval between the instant an alert is displayed and the predicted start time of the conflict associated with that alert. Warning time requirements apply only to aircraft-to-aircraft conflicts when both aircraft are APD eligible at the current time and conflict detection is enabled. Warning time requirements do not apply to missed-alerts or false-alarms.

g. A *missed-alert* occurs when: (1) an aircraft in adherence to its ATC Clearance during the planning-horizon violates separation standards with an airspace or another aircraft also in adherence to its ATC Clearance; and (2) CP does not display an alert predicting this violation to an appropriate controller at least 5 minutes before the predicted start of conflict time. Conflicts that occur within 5 minutes of an amendment will not be considered missed-alerts unless the amendment has been determined to be conflict free through trial planning. Conflicts involving an aircraft that occur within 5 minutes of one of the following actions to that aircraft will not be considered missed alerts: (1) removal from a group; (2) conflict inhibit is removed; or (3) Planned Holding Area was terminated.

h. A *false-alarm* occurs when: (1) an aircraft in adherence to its ATC Clearance during the planning-horizon does not violate separation standards with an airspace or another aircraft also in adherence to its ATC Clearance; and (2) CP displays an alert predicting a violation of

separation standards involving that aircraft to at least one controller. A *false-alarm* also occurs when: (1) CP displays an alert; and (2) the alert is subsequently retracted without an amendment to the ATC Clearance of at least one conflicting aircraft.

To determine compliance with the algorithm accuracy requirements, two aircraft will be in conflict when: (1) their altitudes are within 2000 feet and they are above Flight Level (FL) 290 or their altitudes are within 1000 feet and they are at or below FL 290; and (2) their horizontal separation is less than 5 nautical miles. To determine compliance with the algorithm accuracy requirements, an aircraft and an active Special Activities Airspace will be in conflict when the aircraft penetrates the boundary of that airspace.

When assessing compliance with the algorithm accuracy requirements 35% of all aircraft will have the lowest level of equipage required to receive Air Traffic Control Services under instrument flight rules at each altitude or flight level.

All aircraft in the design workload will adhere to their ATC Clearances. Adherence to ATC Clearance will be determined using the sections describing "ATC Clearances/Separations", "En Route Procedures" and "Pilot/Controller Roles and Responsibilities" in the *Airman's Information Manual* (AIM).

The system shall (DD3666) satisfy the requirement in this section and its subordinate sections while processing the design workload.

3.2.5.5.2.1 Altitude Modeling Errors

The probability shall (DD3671) be less than 0.001 that the maximum absolute difference between the altitudes predicted by CP for an aircraft and those subsequently reported by the Host Computer System exceeds 500 feet during time intervals in which the ATC Clearance does not include altitude changes.

The probability shall (DD3672) be less than 0.10 that the maximum absolute difference between the altitudes predicted by CP for an aircraft and those subsequently reported by the Host Computer System exceeds 1500 feet during time intervals in which the ATC Clearance includes altitude changes.

3.2.5.5.2.2 Current Flight Plans

The average warning-time for current flight plan alerts whose predicted conflict time is more than 10 minutes beyond the current time shall (DD3668) be at least 12.7 minutes. The average warning-time for current flight plan alerts whose predicted conflict time is within 10 minutes of the current time shall (DD3669) be at least 6.2 minutes.

The probability that the difference between the predicted conflict time and the actual conflict for valid alerts is less than 72 seconds shall (DD4283) be at least 0.95.

The system shall (DD4187) not exceed the missed-alert and false-alarm rates in Table 3.2-26, Performance Requirements for Detection of Aircraft-Aircraft Conflicts involving Current Flight Plans, for aircraft to aircraft conflicts. The table contains the upper limits of false-alarm and missed-alert rates for alerts within a flight level. The values are specified as a function of the minimum reported horizontal separation.

The system shall (DD4309) not exceed the false-alarm rates in Table 3.2-27, Performance Requirements for Detection of Aircraft-Airspace Conflicts involving Current Flight Plans, for aircraft to airspace conflicts. The table contains the upper limits of false-alarm rates for alerts within a flight level. The values are specified as a function of the minimum reported horizontal separation. The missed alert rate for actual loss of separation between an aircraft and an airspace for current flight plans shall not exceed 0.001

Distance-based interpolation will be used to determine upper limits of rates for horizontal distances between those listed in the tables[11]. These requirements apply only to aircraft: (1) whose complete ATC Clearance has been entered into the automation system; (2) that are APD Eligible; and (3) that are in regions of the airspace where conflict detection is enabled.

Table 3.2-26: Performance Requirements for Detection of Aircraft-Aircraft Conflicts involving Current Flight Plans

	Minimum Separation Distance (nm)	Upper Limits
False-Alarm Rates		
	more than 5	0.98
	10	0.80
	15	0.35
	23 or more	0.01
Missed-Alert Rates		
	0	0.001
	5	0.02

Table 3.2-27: Performance Requirements for Detection of Aircraft-Airspace Conflicts involving Current Flight Plans

Minimum Separation Distance (nm)	Upper Limits of False Alarm Rates
more than 0	0.995
7	0.75
9	0.49
11	0.24
16 or more	0.01

[11] Given two separation distances in tables 3.2-26 thru 3.2-29, d1 and d3, and the corresponding upper limits of missed or false-alarm rates, r1 and r3, the upper rate limit for some distance d2, where d1<d2<d3, is computed using distance based interpolation as r1+(d2-d1)*{(r3-r1)/(d3-d1)}.

3.2.5.5.2.3 Trial Flight Planning

The Trial Plan false-alarm rate performance requirements will be verified by making trial plans current after CP has predicted that they will enter into conflict during the planning-horizon. Similarly, the missed-alert rate performance requirements apply to plans that are made current after CP has predicted that they will be conflict free during the planning-horizon.

The system shall (DD4191) not exceed the missed-alert and false-alarm rates in Table 3.2-28, Performance Requirements for Detection of Aircraft-Aircraft Conflicts in Trial Plans, for aircraft to aircraft conflicts. The values are specified as a function of the minimum reported horizontal separation during the planning horizon.

The system shall (DD4307)not exceed the false-alarm rates in Table 3.2-29, Performance Requirements for Detection of Aircraft-Airspace Conflicts in Trial Plans, for aircraft to airspace conflicts. The table contains the upper limits of false-alarm rates for alerts within a flight level. The values are specified as a function of the minimum reported horizontal separation. The missed alert rate for actual loss of separation between an aircraft and an airspace for trial flight plans shall (DD4308) not exceed 0.001.

The average warning time for assessing compliance with Trial Plan accuracy requirements will be 23 minutes.

Distance based linear interpolation will be used to determine upper limits of rates for horizontal distances between those listed in the table. These requirements apply only to aircraft: (1) whose complete ATC Clearance has been entered into the automation system; (2) that are APD Eligible; and, (3) that are in regions of the airspace where conflict detection is enabled.

Table 3.2-28: Performance Requirements for Detection of Conflicts in Trial Plans

	Minimum Separation Distance (nm)	Upper Limits
False-Alarm Rates		
	more than 5	0.94
	10	0.71
	15	0.32
	24 or more	0.01
Missed-Alert Rates		
	0	0.01
	5	0.06

Table 3.2-29: Performance Requirements for Detection of Aircraft-Airspace Conflicts in Trial Plans

Minimum Separation Distance (nm)	Upper Limits of False Alarm Rates
more than 0	0.995
8	0.79
11	0.48
13	0.26
19 or more	0.01

3.2.6 Reliability and Maintainability

3.2.6.1 Reliability

All requirements specified in Section 3.2.6, Reliability, will apply to the operational En Route systems at the ARTCC and an SSF at the WJHTC, but not to the stand-alone Test and Training, ESSC, Support, or Academy systems.

Critical operations must be provided continuously. For EDI components that transfer and process critical ATC data, single points of failure must be avoided, redundant hardware and software must be used, automatic recovery actions for hardware and software failures must be provided, and restoration of all services must be accomplished automatically upon recovery from a failure. The system architecture must support all maintenance operations without significant adverse effect on ATC operations.

3.2.6.1.1 Reliability Definitions

The definitions in this section are included for the purposes of Reliability and Maintainability prediction and verification. The meaning of all terms not defined herein will be in accordance with MIL-STD-721, Section 3.

a. Reliability - A characteristic of the system, or part thereof, expressed as the mean time between failures.

b. Service - A service is the appropriate combination of functions as defined in Sections 3.2.1, "ATC Applications", 3.2.2, "Infrastructure Services", 3.2.3, "Operational Position Characteristics", and 3.2.4, "System Operations", supplying processing and communications services between the HCS, EDARC or WARP and R-positions, the HCS and D- and A-positions, the HCS and Flight Strip Printers (FSPs), the HCS and CP servers, the CP servers and D-positions, WARP and CP servers, and between CP servers in neighboring facilities.

c. Service Interruption - A service interruption occurs whenever the system is unable to provide the required operational system functions defined in Sections 3.2.1,"ATC Applications", 3.2.2, "Infrastructure Services", 3.2.3, "Operational Position Characteristics", and 3.2.4, "System Operations". Service interruptions occur as a result of failures of hardware or software in shared equipment providing services to multiple positions.

d. Position Failure - A position failure occurs as a result of a hardware or software failure affecting only that position.

e. Subsystem Failure - A subsystem failure occurs whenever the functions defined for that subsystem can no longer be performed as a result of hardware or software failures occurring within that subsystem.

f. Server Failure - A server failure occurs whenever the functions defined for that server can no longer be performed as a result of hardware or software failures occurring within that server. A CP server is an EDI processor that performs centralized CP application processing.

g. Recovery Time - The time to resume normal operation by automatically switching to redundant resources or restarting software following a service interruption, subsystem failure, server failure, or position failure. The CP application is considered to be in normal operation after a failure when the Aircraft List and all local Host data-based conflicts have been generated for all displays where the data is required.

h. Relevant Failures - Failures (e.g., design defects, hardware malfunctions, computer program errors, incorrect or incomplete technical documentation, etc.) are classified as relevant or non-relevant. All relevant failures will be counted in reliability requirement verifications. Non-relevant failures occur as a result of any of the following factors:

   1) Environmental stresses beyond those specified for the system.

   2) Improper or incomplete operation of equipment and facilities external to the system.

   3) Negligence of operations or maintenance personnel including improper or incomplete corrective or periodic maintenance.

3.2.6.1.2 Reliability Design Criteria

The criteria for reliability design of the system are as follows:

a. The system shall (DD982) be designed to support scheduled hardware and software support maintenance operations without increasing controller workload.

b. Maintenance operations shall (DD983) not increase risk of catastrophic system failure beyond that caused by operating on a single data path.

c. Data paths from HCS and EDARC to the R-Positions shall (DD984) be physically and electrically independent from the data source to the position display generation equipment.

d. Data paths from HCS and EDARC to the R-Positions will be implemented using dissimilar software in the two paths.

e. Data paths from HCS to FSPs shall (DD986) be physically and electrically independent from other data paths.

f. All applications shall (DD987) be capable of restoring their data bases after restart from either recovery data stored within the system or by reconstitution from external sources.

g. The system shall (DD988) be designed to preclude extensive manual re-entry after data loss.

h. The system shall (DD989) have no single point of failure that results in both the Host and EDARC paths being inoperative.

i. The system shall (DD990) provide the capability to monitor the health of all redundant resources and automatically recover from failures for components that are configured with redundant hardware or software in order to satisfy reliability requirements.

j. The average number of times CP requires reconstitution with the HCS due to EDI/CP relevant failures shall (DD3695) not exceed 24 times per year at 24 months after the 1st-site Initial Daily Use (IDU) for the CP initial build.

3.2.6.1.3 Reliability Requirements

The reliability of data paths, positions, servers, and subsystems shall (DD992) meet the requirements specified in Table 3.2-30.

Table 3.2-30: Required MTBF Values for Positions, Servers, Data Paths, and Subsystems

Category of Failure	Mean Time Between Failures (hours)							
	Service Interruptions Less Than or Equal to A		A Recovery Time Boundary (seconds)	Service Interruptions Greater Than A and Less Than or Equal to B		B Recovery Time Boundary (seconds)	Service Interruptions Greater Than B	
Site:	1st	Last		1st	Last		1st	Last
HCS to R-Position Path	300	300	10	N/A	N/A	10	20,000	20,000
HCS to D- Position Path	300	300	10	N/A	N/A	10	20,000	20,000
HCS to A-Position Path	300	300	10	N/A	N/A	10	20,000	20,000
EDARC to R-Position Path	300	300	10	N/A	N/A	10	15,000	15,000
Host to FSP Path	300	300	30	N/A	N/A	30	10,000	10,000
WARP to R-Position Path	300	300	30	3,000	3,000	360	10,000	10,000
HCS to CP Server Path	50	300	10	N/A	N/A	10	3,000	20,000
WARP to CP Server Path	100	500	60	500	1500	600	5,000	15,000
CP Server to CP Server	500	3,000	120	N/A	N/A	120	3,000	20,000
R-Position and M&C-C Sub-position	300	300	30	3,000	3,000	360	7,500	7,500
D-Position	300	300	30	3,000	3,000	360	7,500	7,500
A-Position	300	300	30	3,000	3,000	360	7,500	7,500
M&C-E Sub-position	300	300	30	3,000	3,000	360	7,500	7,500
M&C-H Sub-position	200	300[1]	30	3,000	3,000	360	7,500	7,500
FSP Subsystem	300	300	60	N/A	N/A	60	3,000	3,000
DS Data Recording Subsystem	150	150	60	N/A	N/A	60	500	500
EDI Data Recording Subsystem	25	150	60	N/A	N/A	60	500	500
State Change Reporting Subsystem	1,000	1000	120	500	500	600	5,000	5,000

[1] MTBF requirement for 12 months after 1st Site.

The Mean Time Between Failure (MTBF) requirements for the data paths, subsystems, servers, and positions are divided into two or three major categories based upon the duration of the service interruption. In some cases, separate minimum MTBF requirements are provided for the first and last sites to promote availability growth. The MTBF requirements of

identified components (e.g., data paths, subsystems, servers, and positions) for operational sites between the first and final sites shall exceed the first site values.

The mean time between failure (MTBF) requirements for the components specified in Table 3.2-30 apply to the reliability of the hardware and software serving only that position, sub-position, server, data path, or subsystem. In Table 3.2-30, "1st Site" is defined to be 1st-site IDU for the initial build of CP and "Last Site" is defined to be the 1st Site plus 24 months.

The MTBF values are subject to the following qualifications.

3.2.6.1.3.1 Position Reliability Requirements

A Position consists of equipment and software utilized to display air traffic control and/or status information at a single position in an air traffic control facility. Such equipment may consist of monitors, display processors, display controllers, and cabling. The system uses four types of positions:

a. Radar (R) Position
b. Data (D) Position
c. Assistant (A) Position
d. EDI M&C Position

The D-position CRLD-MCA, CRLD-UA, Time, and Display Control displays shall (DD4194) continue to be available during CP failures, CP scheduled maintenance, and deactivation of CP at a sector.

The D-position CRLD-MCA, CRLD-UA, Time, and Display Control displays shall (DD4195) continue to be available even when CP workloads exceed the design workload.

3.2.6.1.3.2 EDI M&C Position Reliability Requirements

The following requirements apply to the EDI M&C Position:

a. The system shall (DD1004) have the capability to continue operations without interruption whenever one or more M&C Sub-Positions fail.
b. The system shall (DD1006) have the capability to perform automatic recovery actions in response to the failure of any software or redundant hardware without reliance on any of the M&C capabilities defined in Section 3.2.4, System Operations.

The EDI M&C consists of the equipment and software that performs the functions specified in Section 3.2.4.1.2, Monitoring Capabilities, Section 3.2.4.1.3, Control Capabilities, and Section 3.2.4.1.4, M&C Computer Human Interface (CHI).

The MTBF requirements for the EDI M&C Position, as shown in Table 3.2-29, apply to hardware and software failures occurring within the position. The position includes, but is not limited to, processors, attached peripherals, attached data entry and display hardware, system management functions executing on the position processors, and any data paths between position processor components. The position excludes all other position, subsystem, server, and data path hardware and software. The subsystem excludes hardware and software required to maintain the system's state change reporting capability.

3.2.6.1.3.3 Data Path Reliability Requirements

A Data Path consists of equipment and software that are utilized in the system to convey air traffic control and status information between external interfaces and positions, subsystems, or servers and between CP servers located in different facilities. The external interfaces for the Display System are the HCS, EDARC, and WARP. The Display System Data Paths are:

a. HCS to R-Position
b. HCS to D-Position
c. HCS to A-Position
d. EDARC to R-Position
e. HCS to FSP
f. WARP to R-Position
g. HCS to CP Server
h. WARP to CP Server
i. CP Server to CP Server in neighboring facility

The MTBF requirements for any data path supporting multiple operational positions, servers, or FSPs, as shown in Table 3.2-30, apply to hardware and software failures occurring within the path, including, but not limited to, interface devices, communications networks, and system functions, but excluding the individual data entry and display positions, servers, and FSPs.

The CP Server to CP Server in neighboring facility path includes only a single facility's hardware and software affecting the path and excludes the GFE interfacility network, hardware, and software.

3.2.6.1.3.4 Data Recording Reliability Requirements

The DS Data Recording Subsystem consists of the equipment and software used by the system to enable the data recording functions described in Sections 3.2.4.3, System Analysis Recording, for DS data only and the data collection required to support the on-line operator-selectable retrieval.

The MTBF requirements for the Data Recording Subsystem, as shown in Table 3.2-30 apply to the hardware and software affecting that and only that subsystem.

The EDI Data Recording Subsystem consists of the equipment and software used by the system to enable the data recording functions described in Sections 3.2.4.3, System Analysis Recording, for all EDI data recording and the data collection required to support the on-line operator-selectable retrieval.

The MTBF requirements for the EDI Data Recording Subsystem, as shown in Table 3.2-30, apply to the hardware and software affecting that and only that subsystem.

3.2.6.1.3.5 FSP Reliability Requirements

The FSP consists of the equipment and software used by the system to enable the printing of flight strips as described in Section 3.2.3.2.6, Flight Strip Printing Capabilities.

The MTBF requirements for FSP, as shown in Table 3.2-30, apply to the hardware and software affecting only that subsystem.

3.2.6.1.3.6 State Change Reporting Reliability Requirements

The State Change Reporting subsystem consists of the equipment and software used by the system to enable the data collection required to support the on-line operator-selectable retrieval of state change notifications described in Section 3.2.4.1.2.3.2, "State Change Reporting." The subsystem includes the equipment and software used by the system to communicate with the M&C Position, but excludes the M&C Position hardware and software.

The MTBF requirements for the State Change Reporting Subsystem, as shown in Table 3.2-30, apply to the hardware and software affecting only that subsystem.

3.2.6.1.4 Availability Requirements

Service availability is defined to be the probability that the set of hardware and software required to perform the service are correctly functioning at any instant in time.

The CP Service consists of the CP Server, HCS to CP Server Data Path, CP Server to D-Position Data Path, and a single D-Position.

The CP Server consists of the set of equipment and software that performs the functions specified in Section 3.2.1.1, Conflict Probe Functional Characteristics. The server includes but is not limited to, processors, attached peripherals, and application and system management functions executing on the server. The server excludes the data entry and display position hardware and software.

The CP Server to D-Position Data Path consists of the equipment and software that are utilized in the system to convey air traffic control and status information between the CP Server and a D-Position. The path includes, but is not limited to, interface devices, communication networks and gateways, and system management functions executing on data path processors.

The availability of the CP Service shall (DD3715) be at least 0.999 at 24 months after 1st-site IDU for the initial build of CP.

3.2.6.2 Maintainability

The CP (DD3719)shall provide for a Maintenance capability as identified in FAA Order 6000.30B.

3.2.6.2.1 Maintainability Definitions

The maintainability definitions in this section are included for the purposes of Reliability and Maintainability prediction and verification on the system. The meaning of all maintainability terms not defined herein will be in accordance with MIL-STD-721, Section 3.

a. Maintainability - The measure of the ability of the system and its subsystems to be retained in, or restored to, its fully operational status.
b. Mean Time To Repair (MTTR) - The basic measure of maintainability to be used for the system: The MTTR is the sum of corrective maintenance times weighted by the failure rate and quantity of each LRU.

c. Floor Replaceable Unit (FRU) - For restoration purposes, a FRU is an assembly or chassis-mounted component that is easily removed and replaced on the control room floor.

d. Lowest Replaceable Unit (LRU) - For restoration purposes, a LRU is an assembly, printed circuit board, or chassis-mounted component that is easily removed and replaced.

e. Maintenance Significant Items (MSI) - The system's MSIs are cables, backplanes, and antennas.

f. Lowest Replaceable Software Component (LRSC) - For restoration purposes, a LRSC is a separately compilable software unit or collection of units. Restoration at a higher level (for example, temporary replacement with an older version of a package) is not precluded.

3.2.6.2.2 System Maintainability

The system and its subsystems and components shall (DD1036) be designed so that:

a. Maintenance features include the use of modular designed equipment, which enables field level technical personnel to correct equipment failures by replacing faulty LRUs and FRUs. These maintenance features shall (DD1037) provide the technician with the ability to physically remove and replace a diagnosed malfunction or a identified failed unit within 5 minutes for FRUs only.

b. For subsystem employing redundant equipment, repair/replacement of any system LRU, FRU, or MSI excluding the operational positions and the FSPs, shall (DD1038) be possible while all system functional operations continue uninterrupted.

c. Failed resources can be isolated from the system for performance of maintenance operations.

d. The system mean time to repair (MTTR) for all equipment shall (DD1039) be 30 minutes or less. The MTTR will include initial diagnostics, removal and replacement of the initial failed FRU, LRU, or MSI and repair verification. The MTTR will not include loading software or equipment certification.

e. The mean time to restore service (MTTRS) shall (DD1041) be 30 minutes or less.

   1) The maximum time to restore service shall (DD1042) be120 minutes or less for failed FRUs and LRUs

   2) The maximum time to restore service shall (DD2503) be 8 hours or less for MSIs. Restoral times are the times required to restore a failed LRU, FRU or MSI to service whether by replacement or repair of the LRU, FRU or MSI.

   3) These times to restore service are separate from the restoral times specified in Table 3.2-30 which can be met with system design features such as redundant elements and software restarts.

f. Calculation of system times to restore service shall (DD1044) include diagnostic time (fault isolation), removal of the failed LRU, FRU, or

MSI replacement and installation of the new LRU, FRU, or MSI including any adjustments or data loading necessary to initialize the LRU, FRU, or MSI (including any operating system and/or application software), all hardware adjustments, verifications, and certifications required to return the subsystem to normal operation, and repair verification. The MTTRS assumes replacement LRUs, FRUs, or MSIs and qualified repair personnel are available and on-site when needed.

g. The EDI and its subsystems shall (DD1046) be designed so as to minimize the requirement for Periodic Maintenance (PM) to less than one hour per year for each system, subsystem and their respective LRUs and FRUs excluding any mechanical devices (such as printers).

   1) The CP shall not require preventive maintenance more than twice per twelve-month period. The total preventive maintenance time for the CP shall not exceed twelve man-hours per twelve-month period.

3.2.6.2.3 Maintainability Design Criteria

The system design includes the following maintainability features and techniques:

a. All LRUs, FRUs, and MSIs shall (DD1049) be accessible and removable at the equipment's operational location.

b. For subsystems employing redundant equipment the system shall (DD1050) be available for operational use during routine maintenance, hardware and software diagnostics, verification / certification, testing and training.

c. On-Line Diagnostics. The system shall (DD1051) provide the capability for the M&C position to test non-operational assemblies and identify failed assemblies to the LRU and FRU level without any degradation to air traffic operations or to normal M&C monitoring and control functions.

d. Off-Line Diagnostics. All LRUs, FRUs, and MSIs shall (DD1052) be capable of being diagnosed by off-line tests or diagnostics which allow maintenance personnel to test and isolate an indicated fault without the use of operational equipment.

3.2.7 EDI Interfaces

All EDI interfaces developed and implemented for operational use within the DS shall (DD3733) be retained as specified in applicable FAA DSR functional requirement specifications.

The EDI shall (DD3734) provide an additional external interface to each of the following:

a. Host (or Host substitute)

b. EDARC

c. Weather and Radar Processor (WARP)

3.2.7.1 EDI/Host Interface

The EDI/Host interface will provide a capability for EDI applications to exchange message data with the Host as specified in NAS-IR-82170001 (HID/NAS LAN IRD). All message data exchanged between the Host and EDI applications will be exchanged using the content and format specified in NAS-IR-82170001. The interface will also provide the Host a capability to receive a subset of the message data defined in NAS-MD-311 from EDI applications. The content and format of message data accepted from EDI applications will be as specified in NAS-MD-311.

The EDI/Host interface shall provide an DS capability to relay Flight Data Input/Output (FDIO) message data between the HCS and the flight strip printers located at the D- and A-Display positions, independent of the Host/EDI interface specified above. As a minimum, this interface will provide system interface capabilities equivalent to those specified for FDIO interfaces in NAS-MD-581. Content and format requirements for Host input/output messages are defined in NAS-MD-311 and NAS-MD-314.

The system shall provide an additional interface to the Host (or Host substitute) as specified by NAS-IC-22134001.

3.2.7.2 EDI/EDARC Interface

The EDI shall (DD1071)provide a physical and functional interface to the Enhanced Direct Access Radar Channel (EDARC).

The EDI/EDARC interface will process all digital message traffic currently specified for relay between the radar controller position and EDARC. The content and format requirements for messages currently processed by EDARC are identified in NAS-MD-1311 and NAS-MD-1314.

3.2.7.3 EDI/WARP Interface

3.2.7.3.1 R-Position Support

The system shall (DD1081) provide an interface to the WARP as specified in NAS-IC-25152104. The WARP/En Route Display Subsystem interface will provide R-controllers a capability to receive and display weather map products obtained from WARP. WARP weather products will be displayed at the R-position as specified in Section 3.2.3.1.1.8.

3.2.7.3.2 D-Position Support

The EDI shall (DD3742) provide an interface to the WARP located at the respective ARTCCs as specified in the URET CCLD/WARP ICD NAS-IC-22132515 (FAA-AP-1998-1261). This interface will provide the EDI conflict probe functions a capability to receive upper level gridded weather products transmitted from WARP. Functional requirements for weather products to be provided are specified in FAA Specification FAA-E-2898. The WARP upper level gridded weather products will be displayed at the D-position operational display as specified in Section 3.2.1.1.20.8.

3.2.7.4 EDI/VSCS Interface

The EDI shall (DD1089) interface with VSCS, Tracker, and the VSCS Training and Backup Switch (VTABS) in accordance with NAS-IC-21014201. As a minimum, this interface will provide Air/Ground and Ground/Ground communications capability. The hardware and software requirements currently specified for these interfaces are defined in NAS-IC-21014201, Part II.

The communications systems supported by the EDI console position equipment includes Tracker and VTABS. Tracker consists of a second set of VSCS hardware and is optionally contained in selected R-position or D-position to support Tracker/hand-off controller functions. VTABS provides a training and backup system for the primary communications system, i.e., VSCS. VTABS will be contained in either a R-position or a D-position. VTABS will be contained in that console for which it provides a VSCS backup capability.

3.2.8 Environmental Characteristics

The EDI shall (DD1100) meet the environmental requirements described below.

This section shall (DD1101) apply to both commercially available and developed hardware.

The environmental limits specified in this section are for the steady state and apply to both air that is ingested by the equipment for cooling purposes and air surrounding the equipment. Surrounding air parameters shall (DD1102) be measured at three foot or less distance from the equipment and outside of the direct air stream of cooling air exhaust, under floor positive air pressure at nominally 0.05 inches of water at 29.4 degrees Celsius maximum is the normal cooling mode for EDI equipment.

3.2.8.1 Operating Environment

The EDI equipment shall (DD1104) not inhibit the satisfaction of all specified EDI requirements when the equipment is operated under any and every combination of the environmental limits specified below.

3.2.8.1.1 Temperature and Humidity

The EDI shall (DD1106) be capable of continual operation, while maintaining Reliability and Maintainability requirements under the following temperature and humidity conditions:

a. Over the range of +16 degrees Celsius to +29.4 degrees Celsius ambient temperature,
b. Over the range of 20% to 80% relative ambient humidity,
c. Over the altitude range of zero to 7000 feet above Mean Sea Level.

3.2.8.2 Non-Operating Environment

EDI equipment shall (DD1108) provide the power-off, storage and shipping environmental performance specified below.

3.2.8.2.1 Installed Unpowered

EDI equipment exposed to any combination of the conditions specified below for a period of 96 hours or less and with power off, shall (DD1110) be capable of operation without degraded

performance immediately after return of the environment to the operational range specified above and application of power:

a. Temperature range of +10 degrees Celsius to +43 degrees Celsius,

b. Relative humidity range of 20% to 80%.

3.2.8.3 Acoustic Noise

The EDI will be designed to provide an acoustical environment that will not cause personnel injury or fatigue or in any other way degrade overall system effectiveness.

The ambient noise contributed solely by DS equipment shall (DD1123) not exceed the limits specified in FAA-G-2100 reduced by 3dB when measured at the center console of a three console group consisting of an R, D, A position .

Noise measurements shall (DD2457) be made using the methods of MIL-STD-1474 when measured at the seated and standing head positions of the fifth percentile female and ninety-fifth percentile male.

3.2.9 Physical Characteristics

The physical characteristics defined in the following sections describe the display equipment, support system equipment, and equipment cabinets. These characteristics include weight and dimensional limitations, access for maintenance, health and safety criteria, security criteria (in accordance with FAA Orders 1600.6 and 1600.54), equipment layout, relocation capability, installation flexibility, finish and color requirements, and data entry and display devices physical characteristics.

The physical characteristics of the system are contained in the following sections.

3.2.9.1 Loading and Weight Limitations

The loading conditions of each completed equipment cabinet and each Operational Position Suite shall (DD1129) not exceed 125 pounds per square foot.

No removable component (including the display surface unit) shall (DD1130) weigh more than 50 pounds, unless mechanical devices are provided for all necessary handling.

3.2.9.2 Dimensional Limitations

The maximum size of any individual crate or package entering a building shall (DD1132) not exceed external dimensions that allow for ease of transportability through the building from the equipment delivery point to its final location (See FAA standard drawing series D5895, D6228, and E5896).

The minimum clearance en route to the control room floor and the computer equipment location is 71 inches wide by 80 inches high.

3.2.9.3 Access for Maintenance

The design of the Operational Position Console and the D and A position displays shall (DD1135) provide for rear replacement of all modules except that hand carried FRUs weighing not over 50 pounds may be front replaceable.

Removal and replacement of each FRU shall (DD1136) require no more than 5 minutes, except for the position monitors.

When each FRU is in its maintenance position, all LRUs and test points shall (DD1137) be accessible.

The Operational Position Console display positions and LRU module shall (DD1138) remain physically stable when modules are in their maintenance position.

Maintenance from the front which contributes only minor additional light or noise will be permitted. Only hand carried test equipment items which weigh 50 lbs. or less shall (DD1139) be permitted on control floor aisles.

A transportable frame or cart shall (DD1140) be provided for maintenance and transport of operational position equipment modules between maintenance areas in the building including the maintenance aisles behind the Consoles.

All equipment, including electronic equipment modules not housed within the operational position suite but remotely located in the equipment room, shall (DD1141) be configured and located so that maintenance can be performed on the LRU and access is provided to all test points.

The accessibility requirements of FAA-G-2100, Section 3.3.3.4 shall (DD1142) be satisfied by all newly developed equipment.

3.2.9.4 Health and Safety Criteria

The system and support equipment shall (DD1144) be designed to minimize the potential for human error in the operation and maintenance of the system, particularly under heavy work load stressful conditions.

Specific requirements for cathode ray tube (CRT) implosion protection (if CRTs are used), X-ray emission, and structural stability are provided in Section 3.3.2, "Safety Requirements".

3.2.9.4.1 Structural and Seismic Stability

To assure personnel safety, the operational position consoles and all other equipment racks shall (DD1148) be designed and installed so that the equipment, including Tracker and VSCS electronic equipment, remains upright when LRUs are removed for maintenance and when subjected to the earthquake floor response spectra shown in AT&T Bulletin 326-130, PUB 51001 Issue 2.

All equipment mounted in consoles or racks shall (DD1149) remain in place.

The equipment is not required to remain operative during the earthquake but must be capable of being quickly restored after the event with a minimum amount of maintenance.

Access panels, doors, and drawers shall (DD1153) remain in their normal positions under conditions specified above.

The floor response spectra shall (DD1154) apply to installations located in earthquake zone 4 as defined in the above AT&T bulletin.

For installations in zones 1, 2, and 3, the above requirements shall (DD1155) be met except that all accelerations should be reduced by 70 percent, 60 percent and 40 percent, respectively.

These requirements may be accomplished by designing equipment to survive in the seismic environment and by employing tiedowns and anchors fastened to concrete floor slab. Similarly, a single design may be employed in all earthquake zones, or the design may be tailored to meet the expected earthquake threat. Equipment will be designed and installed in accordance with ANSI/IEEE Standard 344-1975.

3.2.9.5 Equipment Layout

All equipment shall (DD1159) be in accordance with the ground workspace design requirements of MIL-STD-1472.

However, the height of the central display panel may exceed the 21 inch maximum specified in MIL-STD-1472, Section 5.7.6.2.2. Equipment layout shall (DD1160) provide clear and unrestricted access to any rack or equipment unit including operational position display consoles in accordance with the requirements specified in the above sections.

This access shall (DD1161) permit maintenance or removal of part or all of the equipment at any rack, unit, or console location.

All equipment shall (DD1162) be maintainable in accordance with the anthropometric requirement of MIL-STD-1472 and operable according to the human engineering requirements.

3.2.9.6 Relocation Capability

It shall (DD2480) be possible to remove, relocate and re-install a fully operational position console within a given building within 2 hours.

FRUs shall (DD1166) be relocatable from their operational positions to a diagnostic and repair location.

All operational position equipment LRUs, and FRUs which may be moved during operation or while performing maintenance actions, shall (DD1167) meet all requirements of this specification with minimum alignment or adjustment.

This shall (DD1168) apply for up to and including 12 cycles of round trip movement between the operation area and the maintenance area.

These trips shall (DD1169) be at normal walking speed.

These trips shall (DD1170) assume use of an elevator in both directions.

The elevator crossover shall (DD1171) be a 2" gap with a 1/2" off-set.

3.2.9.7 Finish and Color

Newly designed equipment shall (DD1173) be finished in accordance with the requirements of FAA-STD-001 except that colors different from those specified in FAA-STD-001 may be used when those specific alternate colors are approved in writing by the Government.

Commercially available equipment will be acceptable in standard manufacturers' color except that all surfaces of operational position console elements that are visible to the Console user during normal operation will be matched in color except for the COTS monitors. The match will be subject to written approval by the Government. Identical equipment will have the same finish and color. The intent of these requirements is to ensure that all hardware looks the same.

Operational position console surfaces reflectivity shall (DD1175) not exceed 50 percent.

Exposed surfaces must be finished to resist wear and scuffing. Textures must be chosen to minimize the appearance of scratches and be cleaned easily. Surfaces that come in contact with operators or their clothing will be free of rough, ragged or sharp protrusions.

3.2.9.8 Operational Position Console Physical Characteristics

The general physical characteristics of the system console shall (DD1178) be in accordance with the human engineering and design criteria established in the design and maintainability requirements of MIL-STD-1472, except as noted as design goals (wills) in Section 3.3.1.1.4.

The front panel configuration used for Tracker equipment shall (DD2481) be as specified in NAS-IC-21014201.

Each R-Position, Ghost Pilot workstation, D-Position, A-Position, M&C-H, M&C-E, and M&C-C Sub-Position Console(s) shall (DD1179) contain, as a minimum, physical devices to provide the following functional entities:

a. Position Display.
b. Cursor pointing /selection device and keyboard data entry, excluding a positioning device for A-Position.
c. Backlit chart holder.
d. Physical dimensions of the combination of R- and D-Positions not to exceed 72 inches wide, 64 inches deep and 79 inches tall.
e. Ghost pilot workstation, A-Position, and the M&C-H, M&C-E, and M&C-C not to exceed 36 inches wide, 64 inches deep and 79 inches tall, not including the map board/box height.
f. The enclosure used for Tracker shall (DD2507) be 10 inches or less in height.
g. All consoles shall (DD2458) have the same height, not to exceed 102 inches.

In addition, the A and D-Positions shall (DD1180) provide the functional entities to accommodate the printing and handling of flight strips.

The A-Position and D-Position of the system shall (DD1181) contain the following functional entities:

a. Flight strip printing.
b. Flight strip holder.

The enclosure on the A-Position normally used for Tracker shall (DD2508) be configured for open front document storage.

Each system shall (DD1182) provide the following functional entities:

The ability to affix and "backlight" translucent documentation, i.e. controller charts, etc.

The electronics for the R-Position and M&C Subpositions shall (DD1183) be totally independent of other positions. The D-Position and A-Position may have common electronics.

The D controller shall (DD1184) have full unobstructed view of the adjacent R-Position display while seated at the D-position operating (keyboard) position with only head movement.

VSCS and Tracker provisions as described in Section 3.2.9.8.4, VSCS Audio System Description.

3.2.9.8.1 Flight Strip Printer (FSP)

The FSP shall (DD1187) provide the functional capability to print strips as defined in NAS-MD-581.

The FSP shall (DD1188) not contribute to an acoustic environment that will exceed the requirements stated in Section 3.2.8.3, Acoustic Noise, except for noise peaks caused by the cutting of the strip.

The FSP shall (DD1189) not compromise reliability and maintainability and serviceability requirements of Section 3.2.6, Reliability and Maintainability and Section 3.2.9.3, Access for Maintenance respectively.

The flight strips shall (DD1190) not be smaller than one (1) inch high and as long as practical, but not greater than 8 inches or less than 5 inches long.

The data coded to be "red" shall (DD1192) be displayed in red or with some other acceptable differentiable characteristic, like underscore, shaded background, reverse polarity, etc.

The paper strips will have a light green tint with a non-glare surface.

3.2.9.8.2 Flight Strip Holder (FSH) Assembly

The FSH assembly shall (DD1194) hold paper flight strips mounted in flight strip holders.

The number of paper flight strips accommodated by the FSH assembly shall (DD1196, DD1197) be 60 flight strips +/- 10% for the D console and 50 +/- 10% for the A console.

3.2.9.8.3 Backlit Chart Holder (BCH)

The BCH shall (DD1199) be located at the top of each position above the enclosure provided for Tracker.

The BCH shall (DD1200) allow for documents 33 inches long by 24 inches high and smaller to be affixed to the backlit surface.

The backlighting shall (DD1201) not cause reflections on any CRT surface in the environment to exceed the limits specified in Section 3.2.9.9, Operational Position Monitor Characteristics.

The BCH shall (DD1202) provide the method to affix the documents to the backlit surface.

The BCH shall (DD1203) be within visual range of the R-Position controller as specified in Section 3.3.1.1.4, Anthropometrics.

The BCH shall (DD1204) provide a means to change documents affixed to the surface and replace documents with minimal impact to the position controller during performance of ATC operations.

3.2.9.8.4 VSCS Audio System Description

The operational position consoles shall (DD1206) interface with VSCS and Tracker console equipment (VCE).

The elements of the VCE are defined in ICD NAS-IC-21014201. Each operational position console position shall (DD1207) also satisfy the VSCS physical/electrical interface requirements specified.

The operational position console shall (DD1208) interface with the VSCS and Tracker console equipment (VCE) which consist of all the elements of the VSCS which are to be installed in or plugged into the operational position console including the following: (Unless otherwise specified the following VSCS requirements shall (DD1209) apply only to R-, D-, and A-Position).

a. One VSCS Electronics Module (VEM)
b. Two VSCS Display Modules (VDM)
c. One VSCS Indirect Access Keypad (VIK)
d. Two Headset Dual Jack Modules (DJMs)
e. One set of Ground to Ground (G/G) loudspeaker (LS) Module and Controls
f. One set of Air to Ground (A/G) LS Module and Controls
g. One Chime Audio Level Control
h. One Footswitch (not included in Tracker)
i. Two Headset Assemblies
j. One VSCS Power Control Switch (VPCS)
k. One VSCS Power Unit (VPU) with associated power umbilicals
l. One set of VSCS Interconnecting Cables.

The R-, D-, and A-Position shall (DD1210) provide a physical location volume for VSCS and Tracker display modules.

The top, bottom, and sides of the VSCS Electronics volume shall (DD1211) be provided with the structural capability to accommodate a slide supported 50 pound module.

In addition, the front and back of the volume shall (DD1212) be provided with the structural capability to accommodate a flange mounted 50 pound module.

Cooling, and maintenance of VSCS, Tracker, and operational position console electronics shall (DD1213) not be limited by the physical interface requirements of this design.

3.2.9.8.4.1 Headset Assemblies

The headset assembly shall (DD1215) comply with Sections 3.3 through 3.15 of specification FAA-E-2603a with the following modifications:

a. Sections 3.3.3.1, 3.3.3.3, 3.5 and 3.13 do not apply.

b. A type PJ778 plug will be provided in lieu of the type specified in Section 3.3.4.5.

c. The cord length will be 15 feet.

d. Only 100,000 push button depressions are required for paragraph 3.3.4.3.

e. In paragraph 3.3.5, the color may also be black or any shade of brown darker than that specified.

f. In paragraph 3.4.2, sensitivity will be within the range of -7 dBm to -15 dBm.

g. The headset assembly will not provide audio level control.

(The Plantronics model SHS-1597 is an example of headset that has the electrical characteristics required by NAS-IC-21014201.)

3.2.9.8.4.1.1 Operational Position Console Audio System Characteristics

The physical, electronic/electrical, and environmental characteristics of items d through f, of Section 3.2.7.2.4, VSCS Audio System Description, of this specification shall (DD1222) comply with NAS-IC-21014201 (VSCS Console Equipment to Console ICD).

3.2.9.8.5 Audio Warning Signals

Caution alarms (indicating awareness) will be readily distinguishable from warning alarms (indicating immediate attention is required) if provided. Since audible alarms will be used in conjunction with a visual display, the display system audible alarm shall (DD1224) be supplementary to information coordinated on the visual display.

An "on/off" display system mechanism shall (DD1225) be provided at the keyboard which will allow the alarms to be activated and deactivated.

The frequency range of audible alarms shall (DD1226) be between 200 and 5000 Hz and preferably between 500 and 3000 Hz.

The signal-to-noise ratio of the alarm shall (DD1227) be at least 20 dB in one octave band at the operator's position.

In order to provide several layers of criticality, coding by dimension if intensity, pitch, and rhythm shall (DD1229) be used.

A "fast reaction" or highly critical signal will be discriminable from all other audio signals within .05 seconds from onset.

3.2.9.9 Keyboard Characteristics

The D-side console shall (DD**) include a single keyboard to accept and process DSR, Host, and CP input.

The keyboard will be easily removable for maintenance or replacement. The layout shall (DD1232) be QWERTY.

A tab key shall (DD1233) be provided if needed to support the Contractor's controller-machine dialogue (e.g., to support "form-filling" dialogues).

Sufficient fixed function keys shall (DD1234) be located on the keyboard, with the function names (or abbreviations) permanently marked on the respective key tops, to support commonly invoked functions.

The number of these fixed function keys shall (DD1235) be adequate to support the Contractor's CHI dialogue design.

Keyboard layout shall (DD1236) minimize inadvertent activation or substitution errors of commonly used keys (e.g., "enter", "delete").

Cursor control keys shall (DD1237) be included in the keyboard.

These dedicated keys shall (DD1238) control cursor movement up, down, left, right one character or symbol space per discreet keystroke.

The cursor symbol displayed for the keyboard cursor shall (DD1239) be distinct from the cursor symbol displayed by the cursor positioning/selection device.

A dedicated number pad shall (DD1240) also be included in the keyboard.

This number pad shall (DD1241) follow the telephone style layout but may include additional keys to accomplish "enter", "tab", "space", "backspace", etc.

Mean life of each keyswitch shall (DD1242) not be less than 30,000,000 actuations.

The CP D-Position keyboard shall support input of EDI keyboard entries.

3.2.9.9.1 Keyboard Thickness

Thickness of the keyboard is defined as the distance between the top of the work surface and the top of the home row of keys (rows containing A, S, D, F, G, H, etc.). If the keyboard is operated from a position on top of the work surface, this thickness shall (DD1244) not exceed 51 mm, thirty mm is the preferred thickness.

3.2.9.9.2 Keyboard Slope

The slope of the keyboard shall (DD1246) be within the range of 15 degrees to 25 degrees.

Keyboard slope is the angle between the horizontal plane and a plane through the key surface centers of keys in the first (bottom) and fourth rows. Ideally, this slope should be incrementally adjustable.

3.2.9.9.3 Key Characteristics

The following requirements address the individual keys on the keyboard:

a. Force for key activation shall (DD1250) be between .25 and 1.5 Newton.
b. Key travel shall (DD1251) be between 2.5 mm and 4.8 mm.
c. Key activation shall (DD1252) be accompanied by a tactile "click".
d. This feedback may be augmented optionally by an operator selectable auditory "click". A visual indication that any locking key is locked shall (DD1253) be provided.
e. Keytops shall (DD1254) be shaped to aid proper finger location, minimize reflections, and provide a suitable surface for legends.

f. Keytop size shall (DD1255) be between 12 and 15 mm square or rectangular, with interceptor spacing of 18 to 20 mm.

3.2.9.10 Cursor Positioning/Selection Device (CPSD) Characteristics

A random cursor positioning/selection device shall (DD1257) be provided as part of the operational position console.

This device shall (DD1258) provide for left or right hand operation.

Similar consideration of right versus left hand operation shall (DD1259) be provided if the CPSD is integrated within the keyboard.

The cursor positioning device shall (DD1260) have an accelerator positioning function than can be enabled or disabled in an operational environment

3.2.9.10.1 CPSD Human Engineering

The dynamic and physical characteristics of the CPSD shall (DD1262) comply with applicable sections of Section 5.4 of MIL-STD-1472, except that free-moving XY controllers need not be cordless and trackballs for the R-Position and Ghost Pilot consoles shall (DD1263) not have less than 120 degrees solid angle exposure.

3.2.9.11 Operational Position Monitor Characteristics

The system shall (DD816) provide consoles that contain monitor(s) that meet or exceed the following requirements, unless otherwise specified on an individual case basis.

Each console position shall (DD817) be capable of allowing a coordinator to stand behind and monitor controllers by allowing viewing of all displays and access to communication jacks and controls without disturbing the controllers.

3.2.9.11.1 Size

The size requirements for each CRT type are defined as follows:

a. R-Position

1) The surface of the CRTs on which the user's eyes focus is the viewing surface. The usable area of the CRTs viewing surface shall (DD820) be 20 inches by 20 inches square.
2) The actual display size shall (DD821) be no less than 19.2 inches wide and 19.2 inches high where the actual display size is defined by the largest rectangle formed by true vertical and horizontal lines which can be inscribed within the enclosure generated on the usable display surface.
3) The usable viewing surface shall (DD822) be flat or a section of a sphere with a radius greater than 135 inches or a section of a cylinder with a radius of greater than 135 inches.
4) If the CRT is implemented using a tri-gun, shadow mask technology. The viewing surface may be a section of a sphere with a radius equal to or greater than 87 inches or a section of a cylinder with a radius equal to or greater than 87 inches.

b. D-Position

1) The diagonal measurement of the Display Screen shall (DD) not be less than 19.7 inches.

2) The usable area of the display screen (the area meeting all specified requirements of the viewing surface) shall (DD) be sufficient to have inscribed within it a rectangle (square corners) no less than 173.0 square inches in area.

3) A-Position

4) The diagonal measurement of the CRT shall (DD824) not be less than 15 inches.

5) The A-Position CRT may be used in D-Positions where the CP application is not supported.

6) The usable area of the CRTs (the area meeting all specified requirements) of the viewing surface shall (DD825) be sufficient to have inscribed within it a rectangle (square corners) no less than 83.0 square inches in area.

3.2.9.11.2 Reflection

Screen reflection of incident light normal to the CRT surface shall (DD829) be less than 18 percent.

3.2.9.11.3 R-Position, M&C-E, M&C-H, and M&C-C, CRT Visual Quality

CRT requirements are stated for symbol generation, graphics, shading, brightness, contrast, data positioning, and color.

3.2.9.11.3.1 General Monitor Symbol Characteristics

The CRT shall (DD833) be capable of meeting all the requirements herein but need not simultaneously present more than two brightness modulation rates or more than 1000 combinations of brightness level, brightness modulation, color, and other specified attributes as follows:

a. Symbol Set

The symbol set shall (DD834) be changeable to any Government selected set containing up to 250 symbols.

b. Font Size

The upper and lower case symbol matrices shall (DD835) be of equal size for each font size.

The portion of the lower case matrix positioned below the upper case matrix for descenders shall (DD836) be a fixed percentage of the matrix size.

The fixed percentage of the matrix size percentage shall (DD837) be within the range of 25 to 35 percent.

Font size is the height of the matrix of potential luminous symbol pixels plus two pixel address increments. The matrix shall (DD838) be at least 9 pixels high by 7 pixels wide for 0.105 inch or less font size and 11 high by 9 wide for fonts of greater size.

The monitor shall (DD839) be capable of simultaneous presentation of the full symbol set in each of three font sizes.

Each symbol shall (DD840) be displayed in the font size selected by the system program from the three sizes available.

Each of the three program-selectable sizes shall (DD841) be selectable by the operator from a set of eight or more sizes which span the range of .10 inch or less through .28 inch or more.

Each size of this set shall (DD842) not exceed the previous size by more than 20 percent, plus one pixel address increment(in the case of a pixel matrix display).

Font width is the width of the matrix of potential luminous upper case symbol pixels plus two pixel address increments. Font width shall (DD843) be between 65 percent and 85 percent of font height.

c. Symbol Spacing

Horizontal spacing between symbol matrices shall (DD844) be maintenance adjustable from two pixel address increments or less to at least 25 percent of the symbol height.

This control shall (DD845) be in steps of one pixel address increments.

Vertical spacing between symbol matrices shall (DD846) be maintenance adjustable from two pixel address increments or less to be at least 50 percent of the symbol height.

This control shall (DD847) be in steps of one pixel address increments.

Vertical spacing between successive rows shall (DD848) be adjustable by simple maintenance control from zero to at least 50% of font size.

This control shall (DD849) be continuous or in steps of not more than 0.010 inch.

d. Symbol Line Width

The pixel characteristics are assumed to be independent of application (symbols or graphic lines) and therefore are sufficiently constrained by Section 3.2.9.9.4 (line width) and 3.2.9.9.3.1.h (Modulation Transfer Function Index) to provide the necessary symbol quality.

e. Symbol Brightness Modulation

The monitor shall (DD852) provide the capability to time modulate the brightness of each displayed symbol independent of every other displayed symbol at every one of the following rates:

- 120 cycles/min (flutter) 4:1 on/off ratio
- 240 cycles/min (blink) 1:1 on/off ratio
- 60 cycles/min (wink) 9:1 on/off ratio
- maintenance adjustable 1:9 to 9:1 on/off ratio, 30-500 cycles/min

These rates and ratios may be modified as required to be compatible with the display refresh rate. The "maintenance adjustment" may be accomplished by software adaptation.

f. Dark Symbols

For a pixel matrix implementation, each symbol of each 250 symbol font shall (DD858) be displayable, independently of every other displayable symbol, as a luminescent symbol and alternately as a dark symbol on a luminescent field.

Dark symbols of a font shall (DD859) utilize a symbol matrix and two or more non-luminescent pixels per segment width.

g. Symbol Location

The monitor shall (DD860) provide automatic offset as necessary to permit each symbol of each font to be located by identification of:

The symbol matrix center point for single symbols (such as track symbols)

The symbol matrix lower left corner (not including descenders) for symbol strings and for single symbols.

h. Modulation Transfer Function Index

A useful measure of symbol legibility is provided by the modulation transfer function (MTF). MTF relates the user perceived luminous response of a display (modulation index) to the spatial frequency of the display input. The modulation index (MI) at a spatial frequency s is given by: MIs = (Lmax - Lmin)/(Lmax + Lmin) where Lmax and Lmin are respectively the average of the five maximum and average of the four minimum luminance values obtained by scanning at right angles a series of five parallel luminescent lines with centers spaced 1/s.

For CRTs employing a sampling aperture (such as a shadow mask CRT) minimum luminance shall (DD861) be the sample rather than the space between samples.

For a pixel matrix CRT, the modulation index for full brightness horizontal, vertical and diagonal lines (45 degrees with respect to horizontal) in each primary color shall (DD862) equal or exceed the values given in Table 3.2-31 at the characteristic spatial frequency and at all locations on the CRT surface.

Table 3.2-31: Characteristic Minimum Modulation Index

Line Orientation	Spatial Frequency S = Cycles/Inch	Inside Quality Circle (MI%)	Outside Quality Circle (MI%)
Vertical and Horizontal	26.1	30%	25%
Diagonal	24.5	40%	30%

Modulation index shall (DD863) be measured at the same CRT locations as those selected per Section 3.2.3.2.5.b for line width measurement.

Since a pixel matrix CRT can accommodate only special frequencies that are integer multiples of: s = 1/2(pixel spacing) and s = 1.41/2(pixel spacing) for diagonal lines, then for pixel matrix CRTs, the requirements of Table 3.2-31 shall (DD868) be extrapolated to frequencies achievable with:

- Two pixels on and two pixels off for horizontal and vertical lines.

- Three pixels on and three pixels off for diagonal lines.

The extrapolation shall (DD869) assume a linear index rise from the Table 3.2-31 frequency and index to 100 percent at zero spatial frequency and a linear index fall from the Table 3.2-31 frequency and index to zero percent at twice the spatial frequency specified in Table 3.2-31.

3.2.9.11.4 R-Position, M&C-C, M&C-E, and M&C-H Graphics

The performance requirements for the generation of straight lines, circles and arcs shall (DD871) be as follows:

a. Lines, Circles, and Arcs

The portion of lines, circles and arcs that are within the active display area of the display coordinate plane shall (DD872) be displayable when the line definition points are within a rectangular portion of the plane that is centered on the active display area and of height and width three times the active display area height and width.

Lines, circles and arcs shall (DD873) be definable as follows:

- Straight lines - by end points.
- Circles - by center and radius.
- Arcs - by center, start point and stop point and alternately by center, radius, start angle and stop angle.

Circles and arcs of less than 0.1 inch diameter are not required. Circles and arcs shall (DD874) meet the brightness uniformity requirements specified for symbols and lines.

b. Line Width

Line width shall (DD876) be measured on a profile obtained by scanning perpendicular to the line (perpendicular to the tangent for curved lines) an aperture equivalent on the CRT surface to 0.0006 inch or less by approximately 0.100 inch and with the long dimension parallel to the line (parallel to the tangent for curved lines).

Single pixel width (non-antialiased) vertical, horizontal and diagonal (plus and minus 45 degrees with respect to the horizontal) lines in each primary color and at the full brightness required by Section 3.2.9.9.4.f.1 (Full Brightness) shall (DD877) have line widths that do not exceed the following:

a) 0.046 inch at the 5 percent brightness points of line profile and 0.0244 inch at the 50 percent brightness point of the line profile for all CRT surface locations within an inscribed circle (quality circle) having as its diameter the usable display height.

b) 0.052 inch at the 5 percent brightness points of the line profile and 0.0275 inch at the 50 percent brightness points of the line profile for all CRT surface locations outside of the "quality circle".

The minimum line width shall (DD878) not be less than 0.014 inch for vertical lines, 0.0078 inch for horizontal lines and 0.0098 for diagonal lines at the 5 percent brightness points of the line profile at all brightness levels between 10 percent and 100 percent of full brightness.

Satisfaction of this requirement shall (DD879) ordinarily be verified by measurement at the two points within the quality circle and the two points outside of the quality circle where line width appears to be greatest.

Selection of the least acceptable areas will be by the Government based on a Government approved test pattern. In event of doubt about the least acceptable areas, up to nine points shall (DD881) be measured.

c. Segmented Lines, Circles, and Arcs

Each line, circle, and arc, independent of every other line, circle, and arc, shall (DD882) be displayed.

When selected, pattern discontinuities at 45 degrees and multiples will be permitted in any of the following five patterns:

1) Spaced dots (2 to 6 pixel length)
2) Spaced short dashes (5 to 16 pixel length)
3) Spaced long dashes (16 to 47 pixel length)
4) Continuous
5) A series of alternate dots (1) and dashes (2) or spaced long dashes (3).

The space between the dot and dash elements of the above patterns shall (DD890) be of a length between 3 and 47 pixels.

The end elements shall (DD891) be excepted from the above length requirements.

Both end points of all lines shall (DD892) be displayed except where the final end point falls on a space element.

Lines, including dash elements, shall (DD893) not overshoot the end points by more than 1 pixel.

For a pixel matrix CRT, compliance with the above requirements may be verified by analysis of the generation algorithms.

d. Graphics Distortion

The component of distortion contributed by the CRT surface and associated drive electronics is constrained by the data positioning section.

The graphics engine output to the CRT surface pixel memory shall (DD896) be a mathematically perfect representation of a line, to within one pixel address increment, including the inherent maximum one-half pixel addressing error.

The graphics engine output to the CRT surface pixel memory shall (DD2479) be a mathematically perfect representation of a circle or arc to within one-half pixel address increment or 0.08 percent of the radius, whichever is greater, excluding the inherent maximum one-half pixel space addressing error.

e. Area Coding

Three shading levels and three easily discriminable Government approved area coding patterns (e.g. cross hatching, dots) shall (DD897) be provided for each of the seven simultaneously displayable colors.

The entire CRT surface area shall (DD898) be assignable independently by area element to one of the three shading levels in each of the seven colors or to no shading and simultaneously to one of the three coding patterns in each of seven colors or to no pattern.

These area elements shall (DD899) not exceed ten pixels width or ten pixels height and satisfaction of this requirement may be verified by analysis of the system software.

When coding is accomplished by shading, the provision shall (DD900) be made for the unambiguous identification of the shading level of each contiguous group of shading elements.

f. **Brightness**

At the least bright CRT location, the line brightness of data of the least bright line orientation shall (DD901) be not less than the minimum full brightness levels of Table 3.2-32.

Table 3.2-32: Minimum Full Brightness and Contrast

Color	Brightness	Contrast Factor
Red	0.6	2.0
Yellow	Note 1	
Green	2.2	7.3
Cyan	Note 1	
Blue	0.4	1.3
Magenta	Note 1	
White	Note 1	

Note 1: The minimum full brightness of Pixel Matrix secondary colors will be obtainable with one of the two primaries at the minimum full brightness given above and the other two primaries at the brightness necessary to provide CIE coordinates satisfying Table 3.2-33.

For a pixel matrix CRT that satisfies the requirement of Section 3.2.3.2.5.f.2.a, satisfaction of this requirement may be verified by showing that horizontal lines at the least bright location on the CRT have line brightness not less than double the levels of Table 3.2-32.

The minimum full brightness of pixel matrix secondary colors shall (DD2417) be obtainable with one of the two primaries at the minimum full brightness given above and the other two primaries at the brightness necessary to provide CIE coordinates satisfying Table 3.2-33.

1. Full Brightness

A full brightness level is associated with each location on the CRT surface. Full brightness for a particular location is the line brightness at which line and symbol data is presented in response to a system command for maximum brightness of that data. The full brightness of line data in the least bright line orientation at the least bright CRT

locations may not be less than the levels of Table 3.2-31 by the requirement in the previous section, but may exceed these levels.

2. Spatial Uniformity of Brightness

Brightness variation is defined in percent as: (B max - B min) x 100/B max.

Brightness variation shall (DD909) not exceed the following:

40 percent area brightness over the entire usable CRT surface for a field of one pixel wide horizontal lines spaced by five off pixels or 30 percent area brightness, at the CRT center and at one Government selected location based on a Government approved test pattern, between this field of horizontal lines and a field of single pixel wide vertical lines spaced by five off pixels.

3. Time Uniformity of Brightness

Time dependent brightness variation, other than flicker, shall (DD910) be imperceptible to the user under all conditions of use.

Time cyclic brightness variation (flicker) shall (DD911) not be detectable by 98 percent or more of the general population under the following conditions:

a) illuminance of 1.5 foot-candles of white light incident normal to the CRT surface;

b) for all colors specified in Section 3.2.9.9.4.j, lines and symbols at full brightness and shading at an area brightness of 30 percent of full line brightness in the "black and white" squares of Figure 3.2-4. The White (w) squares represent areas made up of horizontal lines with 30 percent full line brightness;

c) the observers eyes a distance equal to the CRT height from the CRT centerpoint and approximately on a line perpendicular to the CRT surface at the centerpoint.

b w b w b w b w
w b w b w b w b
b w b w b w b w
w b w b w b w b
b w b w b w b w
w b w b w b w b
b w b w b w b w
w b w b w b w b

Figure 3.2-1: Checkerboard Shading

4. Brightness Decay

Brightness of data discontinued from a particular CRT position shall (DD912) decline to 10 percent or less of the brightness prior to discontinuance within 100 milliseconds of the discontinuance.

The CRT, at the end of CRT surface life, shall (DD914) meet the focus, convergence, geometric distortion and 5% line width requirements of this specification.

In addition, the CRT area brightness for the color white at the center of the screen shall (DD915) be greater than or equal to 11.7 footlamberts where the color white is defined in Table 3.2-33.

Table 3.2-33: Colors For Primary Addition Display

Color	CIE X-Coordinate	CIE Y-Coordinate
Red	.625	.340
Yellow	.453	.467
Green	.280	.595
Cyan	.217	.332
Blue	.155	.070
Magenta	.155	.205
White	.271	.286

5. Line Brightness Measurement

Line brightness shall (DD916) be five times the area luminance from a 0.0976 inch by 0.10 inch square area of the CRT surface having the measured line center approximately one-half way between two sides of the area that are parallel to the measured line.

6. Area Brightness Measurement

Unless otherwise specified, area luminance shall (DD917) be measured normal to the CRT surface and from a 0.010 inch by 0.010 inch square area of the CRT surface.

g. Contrast

Contrast Factor is defined as: Bd/Bb where Bd is the brightness of displayed data in a particular color and at a particular CRT surface location with 0.0 fc illumination of the CRT surface.

Bd shall (DD918) be line brightness for symbols and lines.

Bd and shall (DD919) be area brightness for shading area coding.

Bb is the area brightness of a nonluminescent area of the CRT surface that is within a one inch diameter circle that includes the Bd data area and is not more than 0.1 inch from the center of a 1.0 inch or greater length full brightness line and width 1.5 fc illumination by white light incident normal to the CRT surface.

The contrast factor for each available color at the least bright CRT location and least bright line orientation shall (DD921) be sufficient to satisfy all requirements of this specification.

The contrast factor at full brightness for colors specified in Section 3.2.3.2.5.j shall (DD922) be at least those given in Table 3.2-32 for the least bright line orientation at the least bright location on the CRT surface.

h. Data Positioning

The CRT surface shall (DD923) be addressable (both horizontally and vertically) in increments of not more than 0.010 inch average.

1. When perpendicularly projected onto an ideal plane that is tangent to the CRT at its centerpoint, every vertical line of 0.75 inch or greater length and generated by pixels of a single horizontal address shall (DD924) not deviate at any point by more than one percent of the line length from a line V in the ideal plane.

For each horizontal address, line V is parallel to a straight line in the ideal plane between the projected end points of the display line and separated from that straight line by a distance minimizing the deviation.

2. When perpendicularly projected onto an ideal plane that is tangent to the display at its centerpoint, every horizontal line of 0.75 inch or greater length and generated by pixels of a single vertical address shall (DD926) not deviate at any point by more than one percent of the line length from a line H in the ideal plane.

For each vertical address, line H is parallel to a straight line between the projected end points of the display line and separated from that straight line by a distance minimizing the deviation. The absolute displayed location of a data item addressed to a single point anywhere on the CRT surface shall (DD927) not vary by more than all of the following:

a) 0.004 inch/second
b) 0.010 inch/minute
c) 0.100 inch/hour
d) 0.100 inch/day
e) 0.200 inch/month

The above requirement applies to movements which are not deliberate design feature and shall (DD928) not preclude the provision of a deliberate cyclic movement of the display image for the purpose of extending CRT phosphor life.

For this purpose, the limit to limit excursion shall (DD929) not exceed 0.20 inch.

For this purpose, the average rate shall (DD930) not exceed 0.001 inch per minute.

i. Symbol Positioning

In all cases, the positioning of symbols shall (DD931) be such that portions of adjacent symbols do not overlap.

j. Color

The monitor display shall (DD932) be capable of displaying data in seven colors plus black simultaneously as follows:

1. Primary Addition Display

A CRT that generates color by primary addition (such as a shadow mask CRT) shall (DD933) provide for selection by software adaptation of every seven colors from a palette which includes at least red, blue and green primaries and at least 40 secondary colors formed by proportional combinations of the primaries.

These seven selected colors shall (DD934) simultaneously be available to the system for data display.

These seven selected colors shall (DD935) satisfy all other requirements of this specification.

2. Color Purity

The red, green and blue primaries and all penetration colors shall (DD936) have CIE coordinates which at full brightness and every location on the CRT surface are within 0.020 of the coordinates given in Table 3.2-33.

Except that the red X and the green Y shall (DD937) be permitted a 0.030 deviation from the coordinates given in Table 3.2-33.

Additive secondary colors shall (DD938) have CIE coordinates which at full brightness and every location on the CRT surface are within 0.030 of those given in Table 3.2-33.

3. Color Tracking

At the CRT center, the CIE coordinates of every color shall (DD939) not vary more than 0.030 from the full brightness value over the range of brightness control from full brightness down to 10 percent of full brightness.

4. Convergence

For an additive primary display, misconvergence between every two primary colors shall (DD940) not exceed:

a) 0.013 inch at every location on the CRT surface that is within a circle (quality circle) having a diameter equal to the usable CRT height and centered on the CRT surface centerpoint.

b) 0.020 inch at every location on the usable CRT surface that is outside the quality circle except for the area in c. below.

c) 0.030 inch at every location on the usable CRT surface that is within the triangle formed at each corner [by a straight line between points one inch from] each corner on each side of the usable surface.

3.2.9.11.5 D-Position Visual Quality

This section specifies the requirements for Symbol Generation, Resolution, Brightness, Contrast Ratio, Color, Convergence, Font Size and Emphasis.

3.2.9.11.5.1 Resolution

The resolution shall (DD3856) not be less than 1280X1024 pixel array.

3.2.9.11.5.2 Brightness

The display screen shall (DD3858) have a minimum white area brightness at the center of the display area of 29.0 footlamberts.

White as expressed in CIE coordinates shall (DD3859) be: X = 0.283 +/- 0.030, Y = 0.298 +/- 0.030.

3.2.9.11.5.3 Contrast Ratio

The contrast ratio shall (DD3861) be a controllable feature of the position monitor.

The display screen face plate optical transmission shall (DD3862) be at 69% or less.

3.2.9.11.5.4 Color

The display monitor shall (DD3864) satisfy the color provisions normally associated with a high quality COTS display monitor.

3.2.9.11.5.5 Convergence

The primary color trio pitch of the display screen shall (DD3866) not be greater than .28 mm.

The display shall (DD3867) meet or exceed the following convergence requirements:

a. 0.35 mm the quality circle
b. 0.5 mm outside the quality circle

3.2.9.11.5.6 Font Sizes and Emphasis

The display shall (DD3869) provide various Government selectable font sizes and sets.

Characters will be capable of being emphasized. Characters shall (DD3871) be capable of blinking at rates no less than once per 3 seconds or greater than once per 250 ms. This feature will be programmable if possible.

3.2.9.11.6 A-Position, Visual Quality

This section specifies the requirements for Symbol Generation, Resolution, Brightness, Contrast Ratio, Color, Convergence, Font Size and Emphasis.

3.2.9.11.6.1 Resolution

The resolution shall (DD945) not be less than 1024 x 764 pixel array.

3.2.9.11.6.2 Brightness

The CRTs shall (DD947) have a minimum white area brightness at the center of the display area of 29.0 footlamberts.

White as expressed in CIE coordinates shall (DD949) be: X = 0.283 +/- 0.030, Y = 0.298 +/- 0.030

3.2.9.11.6.3 Contrast Ratio

The contrast ratio shall (DD951) be a controllable feature of all position monitors.

The CRT face plate optical transmission shall (DD952) be at 69% or less for all positions.

3.2.9.11.6.4 Color

The CRTs shall (DD954) satisfy the color provisions normally associated with a high quality COTS CRT device.

3.2.9.11.6.5 Convergence

The phosphor trio pitch of the CRT shall (DD956) not be greater than .28 mm.

The CRTs shall (DD957) meet or exceed the following convergence requirements:

a. 0.35 mm the quality circle
b. 0.5 mm outside the quality circle

3.2.9.11.6.6 Font Sizes and Emphasis

The CRTs shall (DD959) provide various Government selectable font sizes and sets.

Characters will be capable of being emphasized.

Characters shall (DD960) be capable of blinking at rates no less than once per 3 seconds or greater than once per 250 ms. This feature will be programmable if possible.

3.2.9.11.7 Degaussing and Visual Controls

No special action shall (DD963) be required for degaussing a CRT screen.

All adjustments to CRT screens, including degaussing, shall (DS/EDI)(DD964) occur either during power-on of the hardware or during regularly scheduled maintenance procedures.

3.2.9.12 Keypad Characteristics

A keypad shall (DD**) be provided at operational R-position and M&C-C position consoles and be usable by the user at the adjacent D-position (if the D-position exists). Ghost Pilot positions will not have a keypad.

The keypad will be easily removable for maintenance or replacement. The keypad layout shall (DD**) support the control of a subset of R-position Display Controls and Status View functions.

All keys shall (DD**) be located on the keypad, with names (or abbreviations) permanently marked on the respective key tops, to support assigned functions.

Life of each keyswitch shall (DD**) be at least 10,000,000 actuations.

3.2.9.12.1 Keypad Thickness

The thickness of the keypad is defined as the distance between the bottom of the keypad and the top of the key surface. The thickness shall (DD**) be 51 mm (2 inches) or less and designed for one-handed operation.

3.2.9.12.2 Keypad Slope

It is not required that the keypad have a slope.

3.3 Design and Construction

3.3.1 Human Engineering

3.3.1.1 General Position Console Characteristics

All operational adjustments at any position console must be able to be made quickly and easily from the standing or seated position.

Shelf adjustments that are performed from a seated position, using both hands shall (DD1268) require less than 15 pounds of force in any direction.

For purposes of measuring shelf force exertion limits, the shelf shall (DD1269) include all of the shelf-supported devices and integral shelf components that comprise the Contractor's design (and the VSCS equipment.

For purposes of measuring shelf force exertion limits, the shelf shall (DD1270) exclude personal items (e.g., beverage containers, paper, pencils).

More than one adjustment in a series or sequence is acceptable but feedback (results of the motion) must be immediate. Two-handed adjustments are acceptable.

External edges and corners of the position console which could come in contact with the user must have a minimum radius of .2", excluding such items as switches, knobs, buttons, etc.

3.3.1.1.1 Work Surface

The bottom of the work surface of the operator shelf shall (DD1274) be 27" from the floor.

The bottom of the work surface shall (DD1275) extend a minimum of 16.0" from the edge to provide knee clearance.

The bottom surface shall (DD1276) not be angled down from the edge by more than 7 degrees.

The padded edge must be firm enough to provide hand and wrist support.

3.3.1.1.1.1 Work Surface Dimensions

Work surface dimensions shall (DD1279) be large enough to accommodate a keyboard, a pointing device, and a minimum 5 inch by 7 inch writing surface, except that a D-Position with flight strip printer (FSP) is not required to provide the minimum 5 by 7 inch writing surface.

If the work surface is adjustable, the work surface may be angled down toward the operator to a maximum of 7 degrees.

If the work surface is not adjustable, the work surface shall (DD1281) be level.

Equipment placement, e.g., plug-in jacks for the keyboard, a pointing device, and headphone, etc. shall (DD1282) be placed so that they can be accessed from a seated position and so that the wires from these devices do not interfere with normal operations.

Headphone jacks shall (DD1283) be placed so that they can be seen from a seated position, and so plugs can be easily grasped for removal/insertion.

3.3.1.1.2 Knee Clearance

Knee clearance shall (DD1285) be such that the bottom of the work surface extends a minimum of 16.0" in from the edge to provide knee clearance.

3.3.1.1.3 Leg Room

The horizontal distance from the front edge of the work surface to the bottom edge of the surface in front of the operator's feet shall (DD1287) be 27.0" minimum.

If there is a 4.0" area above the floor from the bottom edge, the horizontal distance can be 23.0".

3.3.1.1.4 Anthropometrics

Sitting and standing reach envelopes and vision requirements for the system will be in compliance with MIL-STD 1472D, Section 5.6. The dimension mannequins presented in those figures will be used to test the position and sector design for anthropometric measurements.

3.3.1.2 Positioning of Monitors

The center of the R-position, D-Position, and A-position monitors should get placed as close as possible to 40.0" from the floor except if the display height is adjustable, then the adjustment range shall (DD1293) include 40.0" centerline to floor height.

The requirements of Section 5.7.6.2.2 of MIL-STD-1472 regarding height of the central segment of a console need not be met. All console positions shall (DD1294) accommodate a main display viewing distance range from the eye to the center of the screen of 20.0" to 30.0", measured from an erect seated position.

3.3.1.3 Keyboard Clearance Adjustments

The operational position console keyboard in its highest adjusted position, including attachments, shall (DD1298) not restrict visibility or interfere with access to any controls or any part of the display.

3.3.1.3.1 Connections

Cables and plugs connecting the console to the keyboard, pointing device, and moveable interactive displays shall (DD1300) be secured and reinforced to prevent damage from handling.

3.3.1.4 Auditory Output

Requirements for audible alarms shall (DD1302) comply with Section 5.3 of MIL-STD-1472.

3.3.1.4.1 Audio Warning Signals

Caution alarms shall (DD1304) be readily distinguishable from warning alarms.

3.3.1.5 Keyboard Characteristic

3.3.1.5.1 Palm Rest

A space to rest the palms of the hands shall (DD1307) be provided either integrated within the operational position keyboard or as part of the work station shelf.

3.3.2 Safety Requirements

The following sections provide design requirements to ensure personnel, equipment, and environmental safety. The DS shall (DD1309) meet the requirements of UL 1950 or an equivalent

safety standard for transient protection, grounding, bonding, and shielding of electronic equipment used in support of air traffic control functions.

All COTS equipment shall (DD1310) meet the requirements of UL 1950 Safety Standards or an equivalent safety standard.

The National Electrical Code (NFPA 70) shall (DD1311) apply as the facility standard for safety and environmental requirements.

UL 1950 shall (DD1312) apply as the unit safety requirement.

Due to the personnel and facility safety aspects of these standards, the most current version of UL 1950 and NFPA 70 should be followed.

3.3.2.1 Personnel Safety

The equipment design criteria for all developed equipment shall (DD1315) be in accordance with Requirement 1 of MIL-STD-454, and Sections 3.3.1.3.2 and 3.3.7 of FAA-G-2100 for transient protection, grounding, bonding, and shielding of electronic equipment used in support of air traffic control functions.

The CP equipment shall (DD3918) comply with OSHA personnel safety requirements and operating environment requirements defined in FAA-G-2100.

3.3.2.2 Equipment Safety

The system will be designed to minimize equipment damage, degradation of efficiency, or mission failure due to operator-induced errors, improper cabling, power failure or electrical overstress on components during installation, storage, operation, handling, maintenance, or transportation.

Requirements for specific design techniques for developed equipment include the following:

a. For developed hardware, electrical overload protection shall (DD1319) be in accordance with MIL-STD-454, Requirement 8, for Class 1 equipment.
b. Contacts used on chassis, panels, or cable entrance connectors shall (DD1320) be recessed to prevent breakage or damage.
c. Where mismating of connectors could cause physical or electrical damage, positive means shall (DD1321) be provided to prevent the inadvertent reversing or mismating of fittings, couplings, mechanical linkage, instrument leads, or electrical connections.

3.3.3 Electromagnetic Interference (EMI)

This section contains requirements pertaining to emissions of and susceptibility to various forms of electromagnetic radiation.

The system shall (DD1324) meet the requirements of FAA-G-2100, Section 3.3.2.3.3 except for DS COTS equipment.

The DS, whether newly designed or commercially available equipment, shall (DD1325) neither be degraded by nor degrade the operation of all other DS equipment.

FAA-G-2100, Paragraph 3.3.2.3.3.1, inrush current, is not imposed as part of DS. In the event of a failure, due to EMI, involving non-DS hardware, the contractor will provide the Government an estimate to repair, which will be negotiated.

3.3.3.1 EMI Emissions

Emission - All developed equipment shall (DD1328) meet the conducted and radiated emission limits of MIL-STD-461, Part 7.

All commercially available equipment shall (DD1329), as a minimum, meet the requirements of NFCC Class A.

Any equipment that consists of equipment modified by the addition of COTS equipment which meet the requirements of NFCC Class A shall (DSR/EDI) be deemed as meeting this requirement.

3.3.3.2 EMI Susceptibility

Susceptibility - All developed equipment shall (DD1331) meet the conducted and radiated susceptibility requirements of MIL-STD-461, Part 7.

No developed equipment shall (DD1332) be operationally degraded when each of its AC input leads is individually and/or simultaneously subjected to a pulse of 400 volts in amplitude, 10 microseconds wide at the 50 percent points, and with a risetime of not more than 50 nanoseconds.

In an operational environment, no developed equipment shall (DD1333) be operationally degraded when subjected either to a voltage discharge of 7 kV stored in a 100 pF capacitor and discharged to the equipment case through a series impedance of 500 ohms, or to a transient current with an energy content of 2.45 milliJoules.

In a non-operational environment, no developed equipment degradation or damage shall (DD1334) occur when subjected to a voltage discharge of 12 kV stored in a 100 pF capacitor and discharged to the equipment case through a series impedance of 100 ohms or to a transient current with an energy content of 7.2 milliJoules.

3.3.4 Power

ARTCC Primary Power for operational positions and equipment including backlit charts, flight strip printers, consoles, and displays will be facility critical power 120/208V AC, 60 Hz +/- 0.5 Hz, 3-phase 4 wire, available at ARTCC power panels.

The power voltage tolerances for previously developed equipment or commercial hardware shall (DD1337) be 120/208V +/- 10 volts.

Safety standards of the National Electrical Code shall (DD1338) be met.

The power voltage tolerances for newly developed equipment shall (DD1339) be in accordance with FAA STD-G-2100.

3.3.4.1 Convenience Receptacles

Each operational position console and each equipment cabinet, enclosure or console base which is not an integral part of a commercial equipment shall (DD1341) provide 120 VAC 60

HZ convenience power via NEMA 5-15R receptacles from a non-critical building service power source.

One receptacle shall (DD1342) be accessible from the equipment front.

A second receptacle shall (DD1343) be accessible from the equipment rear.

The convenience power receptacles shall (DD1344) be provided for each position (R, D, and A) and Racks.

These receptacles shall (DD1345) be provided with power via console umbilical conductors which are separate from the conductors providing power to VSCS, Tracker, and VEARS elements within the cabinet or console.

These receptacles will be used to power test equipment, maintenance lights and tools including drill motors and vacuum cleaners.

3.3.4.1.1 Console Communications System Power

Twist lock receptacles, L6-15R, shall (DD1348) be provided below the raised floor so that redundant, conditioned, critical power is provided for VSCS and Tracker.

3.3.4.2 Power Factor

The power factor shall (DD1350) be .70 (lag or lead) on any equipment whose load is less than 2000 watts.

DS equipment having loads in the range of 2000 to 5000 watts shall (DD1351) have a power factor of .8 (lag) to .9 (lead).

For purposes of power and power factor calculation, VSCS power will be assumed to be drawn from one power source rather than from both.

The VSCS power load for Tracker or VSCS is 305 watts with a power factor of 0.85 lagging. The Tracker power load is 305 watts with a power factor of 0.85 lagging.

3.3.4.3 Load Balance

Load balance of the critical power center (CPC) shall (DD2459) be approved by the Government.

Load balance will be achieved during equipment installation by connecting single phase or multiphase loads so that the load on any one phase does not deviate from the average load of the three phases by more than 10 percent under normal operating conditions.

DS loads will be distributed among the critical power panels to achieve load balance and power redundancy.

In addition, the above requirement will be satisfied with DS Consoles configured in-line.

3.3.4.4 Display Console Power

Each position, R, D, A respectively, shall (DD1359) be provided with a set of critical power receptacles located at the rear of each position under a raised floor.

3.3.4.5 Backlit Chart Holder

Each Flight Strip Assembly and Backlit Chart Holder shall (DD1361) be provided with 120 or 208V VAC, 60 Hz power sources.

3.3.4.6 Power Switches

Physically separate guarded switches shall (DD1363) be provided for the operational position console, Tracker, and VSCS power.

These switches shall (DD1364) be easily accessible from the front of the operational position console.

3.3.4.7 Rack Primary Power

The rack assembly equipment shall (DD1367) operate from two separate single phase 208V, 60 Hz, critical power sources when redundant hardware devices are contained in the rack or one single phase 208V, 60Hz critical power source when non-redundant hardware devices are contained in the rack.

The NEMA L6-15R receptacles shall (DD1368) be located at the rear of the rack below the raised floor.

The VSCS rack receptacles shall (DD1369) be located in accordance with Section 3.2.7.5, DS/VSCS Interface.

3.3.5 Cables

COTS cables and connectors will be utilized to the maximum extent possible for the operational position.

3.3.5.1 Umbilical Connection

The operational position console shall (DD1373) provide for connection of six VSCS and six Tracker umbilical cables of approximately 1/2 inch diameter.

The connections shall (DD1374) be accomplished by one of the following methods:

a) Routing of the umbilical cable directly to a connector panel on the VSCS and Tracker VEMs.

b) Connection of the umbilical cable to six umbilical bulkhead connectors on the DS console, and connection to the VSCS and Tracker VEMs through Contractor supplied cables from the bulkhead connectors.

c) The actual cable specification shall (DD1375) be per VSCS specifications.

d) The 6 VSCS and 6 Tracker umbilical cables and 4 supervisor position cables are GFE to the DS Contractor. The DS Contractor will be responsible for the installation of the VSCS and Tracker console hardware and the GFE cables.

3.3.6 Nameplates and Product Markings

All developed equipment shall (DD1377) conform to the requirements stated in MIL-STD-454 Requirement 67 and Section 3.8, 3.9, and 3.10 of FAA-G-2100, except that the following requirement shall (DD1378) be substituted for the requirement in Section 3.9.1:

"All parts which have labels or markings carrying identifying data or ratings shall (DD1379) be mounted so that the data is visible to maintenance personnel without the necessity for disassembly of the part of adjacent functional structural parts.

In absence of visible part markings the part identification may be located adjacent to the part or documentation provided that will clearly identify the part for replacement purposes."

3.3.7 Workmanship for Developed Equipment

Workmanship shall (DD1382) meet the requirements of MIL-STD-454, Requirement 9.

A Contractor workmanship standard deemed acceptable by the Government shall (DD2484) be a substitute for MIL-STD-454 requirement 9.

A subcontractor workmanship standard that is deemed by the contractor to be equivalent to the contractor's standard shall (DD2485) be acceptable.

The use of soft wires on production level printed circuit boards shall (DD1385) be permitted up to the limits specified in MIL-C-28809B, Section 50.2.1.1.

3.3.8 Interchangeability of Equipment

All equipment and parts, including maintenance and test equipment supplied that are interchangeable or replaceable, shall (DD1387) conform to MIL-STD-454 Requirement 7.

3.3.9 Year 2000 Compliance

CP/EDI shall be capable of maintaining date integrity until year-end 2037. Date integrity is defined here to mean the correctness of dates in the sense that processing of date/time data (including, but not limited to, calculating, comparing, sequencing and converting) accurately accounts for all date transitions, such as century and leap year rollovers.

3.4 System Support

This section defines requirements for the non-operational support system used in the maintenance and enhancement of the Display System and the EDI/CP. The system support capability is divided between the System Support Complex (Section 3.4.1) located at the WJHTC and the ARTCC Support system (Section 3.4.2) located at each En Route Center.

3.4.1 En Route System Support Complex

An FAA Support Complex, called the "En Route System Support Complex (ESSC)," shall (DD1390) be located entirely at the William J Hughes Technical Center (WJHTC).

The ESSC shall (DD1391) support the testing, implementation, maintenance, modification, and enhancement of all Operational System and System Support system products.

The ESSC shall (DD1392) support the configuration management, quality assurance, performance assessment and adaptation data management for system products.

The ESSC shall (DD1393) support the development of system modifications.

The ESSC shall (DD1395) contain sufficient hardware, software and interface resources to logically replicate the configuration of the software and hardware of any operational system. The definition of replicate, from a hardware point of view, is that the hardware at the WJHTC is configured to approximate the configuration of the hardware at an ARTCC. The definition of replicate, from a software point of view, is that the sector processors and the simulator processors are loaded with the identical software that resided in the sector processors at a ARTCC.

The test support, configuration management, software development, management support, and field support functions shall (DD1396) be performed by the ESSC for all subsystems.

All national baselines for the systems shall (DD1397) be produced by the ESSC.

3.4.1.1 System Support Facility (SSF)

The capability shall (DD1398) be provided to emulate any user selected number of position consoles in any field and/or test configuration in combination with actual position consoles and position console simulators as available at the ESSC.

Two complete System Support Facilities (SSFs) shall (DD1399) reside at the WJHTC.

At a minimum, each SSF shall (DD1400) consist of a 12 sector configuration of actual position consoles and an M&C position.

The EDARC laboratory shall (DD1401) consist of a stand alone test environment composed of three sector positions which are capable of being connected to an EDARC processor.

At a minimum configuration, the ESSC shall (DD1402) be capable of interconnecting position consoles and position console simulators to simultaneously logically replicate one ARTCC and contain sufficient hardware to provide the capability to test CP interfacility communication among up to 8 CP systems.

The ESSC shall (DD1403) provide a test and evaluation (T&E) facility which consists of a minimum of four actual sectors connected to a support system executing Test NAS.

This facility shall (DD1404) have the capability of being configured with four actual sectors and eight simulated sectors equivalent to 12 Sector Universal Data Set adaptation.

3.4.1.1.1 SSF Control

The hardware, software and interfaces constituting the SSF, EDARC laboratory, and test and evaluation facility resources of the ESSC shall (DD1406) be configurable from a central system position.

This central system position will be termed the Facility Configuration Console (FCC).

The FCC shall (DD1408) include a position for supervising, monitoring, and controlling these resources. Inputs, outputs, and other resources are allocated to each System Support Facility (SSF) by the FCC to replicate any fielded ARTCC configuration. The FCC is interfaced with

the Job Shop to transfer and load the appropriate software and adaptation(s) into a SSF to permit total replication (hardware, software).

The control capability to interface SSFs will be accomplished by the FCC.

The FCC shall (DD1412) have the capability to monitor and control communications between the unallocated resources of the SSFs.

The FCC control capabilities shall (DD1413) not affect the functioning of the SSF areas such that their ability to logically replicate field conditions is diminished. Once the allocation of resources has been done by the FCC, the SSFs will be controlled by the Monitor and Control Console of the SSFs until all resources have been returned to the control of the FCC.

3.4.1.1.2 SSF Configuration Performance

It shall (DD1416) be possible for the FCC to set up within 30 minutes, either the primary channel or the backup of an SSF, starting from a powered up state and completing when the SSF consoles are under M&C control. The 30 minutes include both hardware logical configuration and software download of a single ATC software release.

3.4.1.2 System Modification

3.4.1.2.1 Modification Design Support

3.4.1.2.1.1 Design Generation

The ESSC shall (DD1421) use automated tools to assist in system development.

These tools will be used to support the development of system modifications and enhancements.

3.4.1.2.2 Software Modification Support

3.4.1.2.2.1 Source Edit

The ESSC shall (DD1425) provide an interactive editor capable of creating and modifying program source files, data base structure source files, and data source files.

The editor shall (DD141426) format input so that, upon later inspection, the contents of the source files are in a standard format.

3.4.1.2.2.2 Data Base Structure

Requirement terminated in DSR A093.

3.4.1.2.2.3 Program Compilation

The ESSC shall (DD1430) convert program files to object files.

The ESSC shall (DD1431) provide the capability to store the assembly language and machine code generated from program files.

The ESSC shall (DD1432) perform format and syntax checks on logic files, and consistency and data checks within a given unit.

There shall (DD1433) be a capability to compile any program file.

3.4.1.2.2.4 Adaptation Source File

System adaptation data required by the WJHTC shall (DD1434) be collected and maintained at the ESSC.

The ESSC shall (DD1436) translate adaptation data source files to adaptation object files.

Checks shall (DD1437) be made to verify the format, syntax, data validity, and consistency of the environmental source file being translated.

The generation of the adaptation object files shall (DD1438) be independent of the execution of the system software.

Once a file has been created there shall (DD1439) be a capability to switch it on-line and the old version off line.

The generation of the adaptation object files shall (DD1440) neither interfere with nor depend on the execution of the system software.

The ESSC shall (DD1441) store adaptation object files separately from the system software and make them accessible to appropriate system functions.

3.4.1.2.2.5 Program Object Mapping

There shall (DD1443) be an ESSC capability to automatically gather and link object files after compilation into executable files.

Any inconsistencies in object module linkages shall (DD1444) be reported. The capability will replace specified components of an existing executable file. This function will combine any object files that are needed by the executable files.

3.4.1.2.2.6 Design Traceability

The ESSC shall (DD1447) provide the capability to trace the system requirements / specifications in the proposed system design to the software unit.

3.4.1.2.2.7 Software Maintenance Tools

The ESSC shall (DD2486) provide automated language inspection tools.

The ESSC shall (DD2487) provide the capability to generate cross-reference listings.

The ESSC shall (DD2488) provide automated tools to measure program source size. The ESSC shall (DD2489) provide automated tools to measure program source complexity.

The ESSC shall (DD2490) provide automated tools for Computer Program Unit testing and debugging.

The ESSC shall (DD2492) provide the capability to determine unit test case coverage of a unit.

3.4.1.2.3 Documentation and Configuration Management Support

The ESSC shall (DD1449) have the capability to update and generate all system documentation at the WJHTC. The ESSC shall (DD1450) be provided with an automated configuration management system to track all system modifications from problem or change initiation through development, implementation and fielding.

The ESSC shall (DD1451) provide security so that no changes to the software can be made without authorization.

3.4.1.2.3.1 Software Library Maintenance

The ESSC shall (DD1453) have the capability to maintain a software data base for configuration management purposes and to provide software releases to the ARTCCs.

The software database shall (DD1454) consist of all software, data, and computer-generated documentation.

The library maintenance capability shall (DD1455) include source code, assembly or object code, unit cross-reference dictionaries, load maps, and executable files.

The software library maintenance function shall (DD1456) generate version description documents for all releases.

3.4.1.2.3.2 Document Maintenance

The ESSC shall (DD1458) have an interactive text editor capability to create and update system documents composed of electronic files of merged text and graphics for software and hardware.

The documentation will include, but not be limited to, instruction manuals, user guides, maintenance manuals, functional specifications, logic diagrams, and wiring lists.

Graphics capability shall (DD1460) be included in order to assist in generating and updating charts, schematics, and block diagrams.

Updates shall (DD1461) be made in such a manner that previous versions of the documentation remain available for use until specifically purged.

3.4.1.2.3.3 Accountability Record

The ESSC shall (DD1463) maintain the records for pending and completed system modifications.

Report generators shall (DD1464) provide status in tabular format.

3.4.1.3 System Testing And Verification Support

The ESSC shall (DD1466) provide the tools needed for testing the system hardware and software and for verifying system operation.

These tools shall (DD1467) be used to support the initial system development, the installation of the system, the development of system enhancements, and problem determination and resolution.

These tools shall (DD1468) support ATC operational evaluation of the system as well as technical testing.

3.4.1.3.1 Test Support

The ESSC shall (DD1470) provide the capability to conduct tests and verifications at the unit, subsystem, and system levels.

This capability shall (DD1471) be provided for any version of the unit, subsystem, and system, and shall (DD1472) relate the test results to the version tested.

The capability shall (DD1473) provide all data input and data extraction tools necessary to determine system functional and computer performance and to provide a database to characterize all system hardware and software failures.

When a SSF is configured and interfaced with the Host, EDARC, or both systems simultaneously, it shall (DD1475) be possible to conduct tests using simulated, recorded or live inputs or combinations of simulated, recorded and live inputs. "Live inputs" of interfacility CP data during a system level test in an SSF refers to interfacility CP data input from a site (ARTCC) simulation running in a co-located SSF

It shall (DD1476) be possible to perform a system-level (e.g., with Host, EDARC) test on an SSF configuration using recorded system inputs from an operational ARTCC or simulated ARTCC.

An automated capability to assist in comparing recorded SSF outputs with test outputs shall (DD1477) be provided to support this capability.

A test simulation capability shall (DD1478) be provided.

This simulation capability shall (DD1479) be external to the DS system under test. It will not use DS system reserve capacity or redundant elements.

Capabilities shall (DD1481) be provided for testing all system capabilities, including capacity.

This capability shall (DD1482) provide repeatable inputs and shall (DD1483) be capable of maximum stress and overload testing.

It shall (DD1484) provide for all types of external inputs including manual inputs. If simulated, controller inputs may be limited to the completed message level.

In particular, it shall (DD1485) provide each type of communications and GFE radar surveillance message input for the system including the maximum number of incoming CP interfacility messages.

The capability shall (DD1486) be provided to duplicate the interaction with the Position Consoles not present in the configuration under test.

This capability shall (DD1487) support the quantity of position consoles that the system will support at a maximum ARTCC configuration level. This quantity of consoles may be combinations of the fully equipped position consoles and position console simulators. Position console simulators shall (DD1488) physically duplicate the position console hardware and software, exclusive of the position console data entry and display devices and the mechanical and electrical packaging.

A number of fully-equipped position consoles at which controllers may provide inputs using the appropriated data entry devices, and receive output at the appropriate display devices shall (DD1489) also be provided.

One SSF shall (DD1490) contain the quantity of Position Consoles that the system will support at a maximum stress workload level. These consoles may be combinations of the fully-equipped position consoles and position console simulators.

The simulation capability shall (DD1491) record its inputs and outputs, time-tagged and time synchronized to the Host time source for off-line correlation with the data extracted by the system.

Existing Host-related scenario generation tools and simulation drivers shall (DD1492) be upgraded, as needed, to provide system level test capability when the system is integrated and interfaced with the Host, EDARC, or both systems simultaneously.

3.4.1.3.1.1 Functional Performance Data Collection

The ESSC shall (DD2493) collect the system performance data to determine system performance to include system generated performance data, end-to-end response time data, console command inputs, and data generated by the components being tested.

The ESSC shall (DD2494) be capable of collecting functional performance data.

3.4.1.3.1.2 Computer System Performance Data Collection

The ESSC shall (DD2499) provide the capability to monitor performance data at the M&C-H, M&C-E subpositions and FCC position during system performance tests.

The ESSC shall (DD2495) provide the capability to record measurements of actual system processor utilization (excluding bridges and excluding display generators), input/output peripheral attachment utilization (excluding RS422 keyboard devices), peripheral device utilization (excluding graphics adapters), software routine execution times, software address space utilization, and end-to-end response times during system performance testing.

The ESSC shall (DD2496) provide the capability to record the time-oriented list of operating system services and process context switches;

a. that occur during software execution,
b. which include the activation and deactivation of a process,
c. dispatching and interrupting a process,
d. initiation and completion of an I/O transfer,
e. beginning and end of a wait state,
f. allocation and deallocation of memory,
g. acquiring and releasing a lock,
h. enqueuing and dequeuing for a resource,
i. signaling processes,
j. and posting processes.

The ESSC shall (DD2497) include the capability to select the data to be collected. The collected data will be used to assess system performance.

3.4.1.3.1.3 Scenario Generation Capability

The ESSC shall (DD1503) provide the capability to generate scenarios to be used in test execution.

The scenarios shall (DD1504) be generated for any level of testing.

The scenario generator shall (DD1505) be capable of generating scenarios for system components and providing test data for each component selected.

The ESSC test input for test data shall (DD1507) be capable of accepting data that will test the complete range of data values applicable to the system component specification specified.

Once a scenario is specified, it shall (DD1508) be stored in a scenario database for future use.

There shall (DD1509) be the capability to create additional scenarios by modifications to existing ones.

The scenario generator shall (DD1510) be able to generate scenarios from data previously recorded at each individual site.

The scenario generator shall (DD1511) be able to develop scenarios from input parameters for performance tests. These input parameters, which are selectable from a predefined set of workload drivers, are related to the adaptation database, and the parameters which characterize the air traffic control load.

The scenario generator shall (DD1513) be able to combine selected portions of an existing scenario with predefined stimuli in order to trace the operation of selected "threads" or sequences of program elements.

The SSF shall (DD1514) be used to evaluate the scenario generation in meeting specific goals defined by the input parameter set.

3.4.1.3.2 Verification Support

The ESSC shall (DD1516) provide the capabilities to analyze and report on system performance during and after system and subsystem tests.

3.4.1.3.2.1 Functional Performance Data Analysis

The ESSC shall (DD1518) reduce, analyze, and provide functional test reports on the recorded functional performance data.

The analysis reports shall (DD**) include but not be limited to:

a. The functional performance data satisfying a given set of conditions (e.g., time period, data type).
b. A presentation of the stimuli and responses for a given test and/or series of tests.
c. A determination of coding statements and paths exercised.
d. Identification of the test configuration, test scenarios, and test parameters.

3.4.1.3.2.2 Computer System Performance Data Analysis

The ESSC shall (DD1521) reduce, analyze, and provide reports on computer performance at the system and subsystem level. The analysis and reports will include throughput, computer resource utilization, data base utilization, software utilization, memory maps, input and output response time analysis.

3.4.1.4 Field Support

The ESSC will provide support to the Air Traffic Control Facilities in the areas of deployment of software modifications and the resolution of software or hardware errors or faults. The releases will be maintained in the data base for historical purposes.

The global adaptation data for all ARTCCs shall (DD1524) be centrally maintained and configuration managed within the ESSC.

This data base shall (DD1525) be checked for consistency and completeness at the WJHTC.

The system shall (DD1526) support the storage of operational software and related adaptation data.

The number of versions to be stored shall (DD1527) be five, the current version, previous version, and three versions under test.

3.4.1.4.1 Modification Deployment Support

The ESSC shall (DD1529) provide the capability to manage and to distribute by tape and transmit by electronic link executable system software modifications to the air traffic control facility to correct software faults or add or enhance a required function.

The time to deploy the largest system load module via electronic link shall (DD1531) be 30 minutes or less.

These software modifications will replace current executable units.

The ESSC shall (DD1534) have the capability to record all local changes to the ARTCC adaptation files. These data will be used for testing activities and problem resolution.

The ESSC will be capable of insuring that initial software releases and subsequent updates to the system software does not cause degradation of the operational functions or current interfaces of the software being replaced or other systems that interface with software being replaced at the operational sites.

3.4.1.4.2 Field Problem Resolution Support

The ESSC shall (DD1539) provide the capabilities and the tools to support the resolution of hardware and software field problems.

The diagnostic support requests shall (DD1540) provide failure or error information such as the unit in which the error occurs, type of error, system status and configuration at time of error, and any information that will assist in resolution of problem.

The ESSC shall (DD1541) provide the capability to analyze ARTCC system diagnostic response data received from the field ARTCCs and determine the areas where performance does not meet the expected results. Diagnostic reports shall (DD1542) be generated and output at the ESSC to provide results of the analysis and the details of the diagnostic activity. Information to enable system personnel to determine appropriate actions will be provided.

3.4.1.5 Data Reduction and Analysis

The system will provide an off-line Data Reduction and Analysis (DR&A) capability. DR&A shall (DD1545) provide the capability to print decoded hard-copy lists, reports of selected data, or display data graphically.

a. The system shall (DD1546) provide the capability to perform all DR&A functions with no impact on the on-going system operations.

b. This DR&A capability shall (DD1547) apply to all developed system and Host software. For software developed for the Host, this can be accomplished using newly developed tools or expanding existing Host tools.

3.4.1.5.1 DR&A Lists and Reports

The system DR&A list and report capability:

a. Shall (DD1551) provide the capability to format outputs similar to the current outputs from the NAS En-Route Stage A Data Reduction and Analysis Tool (DART) and presented in a format that is more textual, but include all pertinent information, and not described using binary representation.

b. Shall (DD1552) provide the capability to select the data to be processed, output, or both with logical combinations of criteria.

c. Shall (DD1553) provide the capability to obtain a report of all information recorded for a unique identity stored in the system. For example, it shall (DD1554) be possible to obtain a report of all information recorded for a specific flight selectable by aircraft identity or other unique identity stored in the system. This shall (DD2413) be adequate to reconstruct the history of that flight.

d. Shall (DD1555) provide the capability for the reduction of recorded data to produce reports on the detailed internal behavior and performance of the system.

e. Shall (DD1556) provide capability to support comparison of two separate sets of recorded SAR data. This shall (DD2410) apply to Host and system SAR recordings.

3.4.1.5.2 DR&A Graphical Displays

The system DR&A Graphical Display capability:

a. Shall (DD3995) provide the capability to select the data to be processed, output, or both with logical combinations of criteria.

b. Shall (DD3996) provide the capability to graphically display data necessary to evaluate the performance of CP.

3.4.1.6 Support System Management

Provisions for information management of the capabilities will be provided to implement the support system management functions.

The support system management tools will be expandable to support all transitions and be capable of supporting the system throughout its life cycle.

3.4.1.6.1 Operational Status of Equipment

The ESSC shall (DD1563) provide the capability to monitor the operational status of all ESSC equipment.

The ESSC shall (DD1564) provide the capability to report the operational status of all ESSC equipment as a display, and, upon command, as a printout.

3.4.1.6.1.1 Operational Status of Unique Equipment

The ESSC shall (DD1566) provide the capability to monitor and report operational status of interfaces as required in Section, 3.4.1.7 ESSC Interfaces.

3.4.1.6.1.2 System Operational Status

The ESSC shall (DD1568) provide the capability to display the current ESSC configuration, showing the connectivity of all allocated system resources.

The ESSC shall (DD1569) provide the capability to command reconfiguration of these resources.

The ESSC shall (DD1570) provide the FCC with the capability to monitor and report the operational status and current configuration of its constituent resources as defined in Section 3.4.1.

3.4.1.6.2 Field Support Information Management

The ESSC shall (DD1572) provide an Information Management capability that will aid in identifying field ARTCC problems, classifying the severity of the problems, and specifying required support criteria for various solutions.

The ESSC shall (DD1573) provide the capability to request and receive ARTCC problem information for analysis and be able to selectively download each required problem solution to the appropriate location. The existing INFO management system employed for the Host system will be evaluated for fulfilling this requirement.

3.4.1.7 ESSC Interfaces

The ESSC supports the development, test, and evaluation of modifications and provides centralized national support to the system.

In order to perform these functions effectively, the environment at the ESSC should duplicate the field as far as possible. In addition, there will be several interfaces to equipment unique to the ESSC which are used primarily for testing and field support.

The ESSC shall (DD1577) interface with equipment and facilities for the purpose of developing, testing, and verifying system modifications in an environment that duplicates the field as closely as possible. Most of this equipment will be collocated with the ESSC at the WJHTC.

3.4.1.7.1 Remote Interface

The communications capabilities shall (DD1581) accommodate ESSC operational telecommunications requirements for distribution of system data and software modifications.

The data transmission capabilities shall (DD1582) conform to the American National Standard Institute Publications ANSI T1.617-1991, ANSI T1.617a-1994, and ANSI T1.618-1991.

3.4.1.8 System Capacity

The ESSC shall (DD1585) be capable of supporting a concurrent user population of 100 of which 50 users were performing software development at any one time. ESSC shall (DD1586) provide a minimum of 50 GBytes of Direct Access Storage (DAS).

The ESSC shall (DD1588) have the capability to retain, on-line, five versions of operational software.

The ESSC shall (DD1589) have the capability to retain, on-line, five versions of support software.

3.4.2 ARTCC Support

System support functions shall (DD1591) be located at each ARTCC and will provide for processing of the capabilities listed in the following sections.

3.4.2.1 Local Adaptation

Adaptation data that is unique to individual ARTCCs will be controlled by each individual ARTCC. ARTCC-specific adaptation data will be collected, modified, translated and stored on the local file system.

a. The ARTCC support functions shall (DD1594) collect and manage any ARTCC-specific adaptation data required by the system, using an automated tool which incorporates data validation and error detection. Data validation shall ( ) include, but not be limited to, missing data, in-range reasonableness and type checking, and cross validation to identify conflicts.

b. The ARTCC support functions shall (DD1596) translate ARTCC adaptation data source files to ARTCC adaptation data object files.

c. The ARTCC support functions shall (DD1597) store adaptation data source and object files on both on-line and off-line storage media.

d. The ARTCC support functions shall (DD1598) accept and store ESSC-generated adaptation data object files on both on-line and off-line storage media.

e. The ARTCC support functions shall (DD1599) provide the capability to convert and store adaptation data object files required by the system.

f. The ARTCC support functions shall (DD1600) provide a simple change tracking mechanism for ARTCC-specific adaptation data.

3.4.2.2 GEOMAPS

The ARTCC support functions shall (DD1602) provide the capability to convert and store ACES-generated GEOMAPS object files.

The ARTCC support functions shall (DD1603) store converted GEOMAPS object files.

3.4.2.3 System Distribution

The ARTCC support functions shall (DD1605) be capable of remote access to the ESSC to initiate software release distribution. The ARTCC support functions shall (DD1606) have the capability to build ARTCC releases based upon the distributed software release and local adaptation data.

The ARTCC support functions and ESSC system build functionality shall (DD1607) be identical.

The ARTCC support functions shall (DD1619) provide an electronic interface with the system for the purpose of software release download.

a. The ARTCC support functions shall (DD1608) provide the capability to accept and store, on-line, a minimum of five complete system releases from the ESSC.
b. The ARTCC support functions shall (DD1609) provide the capability to store received ESSC releases on off-line storage media.
c. The ARTCC support functions shall (DD1610) provide the capability to tailor the system release with ARTCC-specific adaptation data and system configuration information.
d. The ARTCC support functions shall (DD1611) be capable of storing system images and build reports on-line as well as on off-line storage media.
e. The ARTCC support functions shall (DD4219) be capable of applying code modifications sent from the ESSC.

3.4.2.4 Site Data Reduction and Analysis

The ARTCC support functions shall (DD1613) provide the capability to conduct off-line system analysis and troubleshooting.

The system Data Reduction and Analysis (DR&A) lists and reports shall (DD1614) be formatted similar to the current outputs from the NAS En Route Stage A Data Reduction and Analysis Tool (DART) and presented in a format that is more textual, but include all pertinent information, and not described using binary representation.

The DR&A capability shall (DD1615) accept recorded data from multiple media, including the NAS System Analysis Recording (SAR) and any separate recording capability, merge these data for reduction and analysis and produce outputs of data which is merged in chronological order

It shall (DD1616) be possible to store DR&A reports on off-line storage media.

It shall (DD1617) be possible to compare selected Data Reduction and Analysis outputs with previously recorded outputs and produce a list of all differences.

3.5 Security

This section contains the security requirements for the system and its support subsystems. System support subsystems include all equipment delivered to the DSSC as part of the system, plus all system support equipment at each site. The system and support subsystems will be in compliance with all appropriate security standards.

The system and support subsystems shall (DD1624) be in compliance with FAA Order 1600.54B, "FAA Automated Information Systems Security Handbook."

The remainder of this section details the specific security requirements of the system, and not the support subsystems.

3.5.1 Definitions

The following definitions apply to all of the requirements in this section:

3.5.1.1 Security Objects

Security objects are passive entities that contain or receive information. System security objects include, but are not limited to, all system files, database tables, devices, interprocess communication messages, and user-invocable system functionalities.

3.5.1.2 Security Subjects

Security subjects are active entities that cause information to flow among objects. System security subjects are users and processes acting on behalf of users.

3.5.1.3 External Interfaces

External interfaces are direct electronic connections to the system, any portion of which lies outside of the physically secure areas of the site. External interfaces include all electronic interconnections to other locations, including other FAA sites, the FAA Technical Center, and the FAA Academy, and include both permanent and temporary connections (e.g., dial-in/dial-out connection over the public switched telephone network). System external interfaces include only direct connections to the system, and do not include connections made to the system only through the Host.

3.5.2 Identification and Authentication

The system will provide the following identification and authentication functions:

3.5.2.1 User Profile and System Security Data Management

The system will provide for the maintenance of security profile data for each user, and of system security data.

3.5.2.1.1 User Profiles

The system shall (DD1641) provide the capability to maintain, for each user, a security profile, to include, at a minimum, the following information and functionalities:

a. A user identification that is unique to that user.

b. A user password that is unique to that user.

c. The elapsed time interval, to a granularity of not longer than one calendar day, since the user's password was most recently changed.

d. The set of operational responsibility designator for which that user is authorized, to a granularity of at least the system position designations (including Radar, Data, Monitor and Control positions).

3.5.2.1.2 User Profile Maintenance

The system shall (DD1643) provide to an authorized user the capability to examine and maintain user profile and system security data, to include, at a minimum, the following:

a. The security profile of each user.

b. The minimum and maximum length of all user passwords.

3.5.2.1.3 Password Change by an Authorized User

The system shall (DD1645) provide the capability for an authorized user to change the logon password of any user, without being required to specify the old password.

3.5.2.1.4 Limiting Profile Maintenance to Authorized Users

The system shall (DD1647) ensure that the ability to examine or maintain user profile or system security data is limited to authorized users.

3.5.2.1.5 Immediate Effectiveness of Profile Changes

The system shall (DD1649) provide to an authorized user the ability to maintain user profile and system security data from a single point within the system, with such alterations becoming effective immediately throughout the system.

3.5.2.1.6 No Single Point of Failure for Logon

The system shall (DD1651) ensure that there is no single point of failure within the system that might prevent valid users from logging onto the system.

3.5.2.2 Logon and Sign-in

This section specifies the requirements for the different varieties of logon and sign-in commands in system: logon/enable data entry devices and logoff, pending logon and cancel pending logon, piggyback logon and logoff, and sign-in and sign-out.

3.5.2.2.1 Logon/Logoff

The logon command indicates to the system that the user will become accountable, after command acceptance, for all the entries made at that operational console.

The system will allow only one user at a time to logon to each operational console. Furthermore, the system will allow a user to logon to a console only if the operational responsibility field of the user's profile indicates that the user has been authorized for that position.

a. The system shall (DD1657) provide the capability for a user to logon to a operational console.

b. The system shall (DD1658) require entry of the user's valid password before granting a logon.

c. If the user's profile authorizes him/her for the position for which that console is configured, the system shall (DD1659) allow the logon.

d. If the user's profile does not authorize him/her for the position, the system shall (DD1660) reject the logon, and notify the user of the situation.

3.5.2.2.1.1 Data Entry Devices

The system will accept the entry of commands from each enabled input device (keyboard and trackball).

a. Upon entry of a valid password, the system shall (DD1665) enable all input devices at that operational console.

b. Prior to the devices being enabled, the system shall (DD1667) accept from those devices only the entry of the logon command, or a pending logon or piggyback logon command that has been automatically converted to a logon command.

3.5.2.2.1.2 Existing Logon and Existing Pending Logon

When a user logs on to a operational console at which there is an existing logged-on user, the system shall (DD1669) logoff the old user and logon the new user.

When a user logs on to a operational console at which there is an existing pending logon, the system shall (DD1670) cancel the pending logon, logoff the old user, logon the new user, and notify the new user that a pending logon was canceled for that console.

3.5.2.2.1.3 Password Change

Upon any logon that occurs within an adaptable number of days prior to the expiration of a user's password, the system shall (DD1672) notify the user of how many days are left before expiration.

The capability shall (DD1673) be provided for password change by the user at any time prior to expiration, and up to an adaptable number of days after expiration.

The password change shall (DD1674) become effective immediately throughout the system.

3.5.2.2.1.4 Status Display

The system shall (DD1676) display user identification and time of logon.

3.5.2.2.1.5 Logoff

The logoff command indicates to the system that the user will no longer be accountable, after command acceptance, for the entries at that console.

a. The capability shall (DD1680) be provided for a user to logoff a operational console.

b. When a user logs off a operational console at which there is a pending logon, the system shall (DD1681) automatically logon the pending logon user.

3.5.2.2.1.6 Logoff and Sign-out

When a user logs off a operational console, the system shall (DD1684) automatically sign-out that user from that console.

3.5.2.2.1.7 Monitor and Control Position Logoff

When a user logged in to a operational console configured as a Monitor and Control position requests to logoff, the system shall (DD1688) require the entry of the user's valid password to proceed with the logoff command.

When the logoff is requested of a console at which there is no pending logon, and there are one or more piggyback logons, the system shall (DD1689) display a message to the logged-on user notifying him/her of the situation.

In this case, the system shall (DD1690) require a confirming action by the logged-on user to proceed with the logoff command.

When confirmation is received, the system shall (DD1691) logoff the logged-on user and automatically logoff all piggyback users for that console.

3.5.2.2.2 Pending Logon/Cancel Pending Logon

The pending logon command indicates to the system that the user will become accountable, after command acceptance, for all the entries made at that operational console when the current user of that console logs off. That is, the system will automatically logon the pending user when the current logged-on user logs off. The system will accept only one pending logon at a time for each operational console.

a. The system shall (DD1695) allow a user to issue a pending logon command to a operational console.
b. If a user attempts to enter a pending logon command at a operational console where a pending logon exists, the system shall (DD1696) reject the second pending logon command.
c. When a user attempts to enter a pending logon at a operational console where there is no logged-on user, the system shall (DD1697) automatically convert the command to a logon request and notify the user of the conversion.
d. The capability shall (DD1698) be provided for the user to cancel a pending logon request at a operational console.

3.5.2.2.2.1 Deleted

3.5.2.2.2.2 Status Display

The system shall (DD1702) display user identification and time of pending logon.

3.5.2.2.2.3 Piggyback Logon/Logoff

The piggyback logon command qualifies a user, after command acceptance, for future invocation of an adapted set of privileged Monitor and Control commands at a operational console. Piggyback logon and piggyback logoff commands will be accepted only from operational consoles configured as the Monitor and Control position. Users granted piggyback

logon by the system will be accountable, after command acceptance, for entry of privileged commands at the designated console.

a. The system shall (DD1707) accept piggyback logon and piggyback logoff commands only at operational consoles that have been configured as Monitor and Control positions.

b. The system shall (DD1708) require reentry of the user's password prior to execution of each privileged command.

c. The system shall (DD1709) record the command/password association for each execution of a privileged command.

d. The system shall (DD1710) allow up to nine users to be simultaneously piggybacked onto each logged-on Monitor and Control console.

3.5.2.2.2.4 Logon Conversion

When a user issues a piggyback logon command, the system will determine whether a different user is already logged-on to that console.

a. When no user is logged on to that console, the system shall (DD1713) automatically convert the user's piggyback logon command to a logon request, and notify the user of the conversion.

b. When a user requests logon to a operational console at which that user already has piggyback logon, the system shall (DD1714) logoff that user's piggyback and logon the user to that console.

3.5.2.2.2.5 Password and Profile Checking

a. The system shall (DD1716) allow piggyback logon only for those users whose profiles authorize them to logon to a Monitor and Control position.

b. The system shall (DD1717) require entry of the user's valid password before granting a piggyback logon.

c. The capability shall (DD1718) be provided for the user to change their password at the time of piggyback logon.

3.5.2.2.2.6 Status Display

The system shall (DD1720) display the following piggyback logon information: identification of each user and time of piggyback logon.

3.5.2.2.2.7 Piggyback Logoff

The piggyback logoff command indicates to the system that the user will no longer be eligible, after command acceptance, for the entry of an adapted set of Monitor and Control commands.

a. The capability shall (DD1724) be provided for a user to piggyback logoff each piggyback logged-on operational console.

b. When the logged-on user attempts to logoff a console at which there is no pending logon and there is a piggyback logon, the system shall (DD1725) display a message to the logged-on user notifying him/her of the situation.

c. In this case, the system shall (DD1726) require a confirming action by the logged-on user to proceed with the logoff command.

d. When the system accepts the logoff command, all piggyback users for that console shall (DD1727) be automatically logged off.

3.5.2.2.2.8 Privileged Commands

a. The capability shall (DD1729) be provided to designate an adapted set of Monitor and Control position input commands as privileged commands.

b. For each of these privileged commands, the system shall (DD1730) require the entry of an authorized user password prior to processing the command.

c. For these privileged commands, the system shall (DD1731) determine whether the password is one of the authorized passwords associated with either the logged-on user or a piggyback user.

d. Upon password verification, the system shall (DD1732) accept and process the privileged command.

e. If the user password is not verified, the command shall (DD1733) be rejected.

3.5.3 Access Control

The system will provide the following access control functions:

a. The system shall (DD1750) control all access by any security subject to any security object.

b. The system shall (DD1751) provide the capability to control access to security objects by any security subject to the granularity of a single user.

c. The system shall (DD1752) provide the capability to control access to security objects by any security subject to the granularity of a single security object.

3.5.4 Security Audit and Review

The system will provide the following security auditing and review functions:

a. The system shall (DD1755) be able to create and maintain an audit log of all security relevant events.

b. The system shall (DD1756) protect the audit log from modification or unauthorized access or destruction.

c. The system shall (DD1757) provide the capability to audit, at a minimum, the following security relevant events:

1) Commands issued by users
2) Response to failed commands
3) System generated alerts
4) Software failures

d. The system shall record, at a minimum, the following information with each recorded security relevant event:
   1) Date
   2) Time
   3) Type of event
   4) System source for user-entered commands
e. The system shall (DD1758) provide for selecting events and users to be audited.
f. The system shall (DD1761) provide for both on-line and printed audit reports.

3.5.5 Network Security

The system will provide the following network security functions:

a. The system shall (DD1764) provide identification and authentication to and from all external interfaces.
b. The system shall (DD1765) provide mechanisms to prevent unauthorized access from any external interface.
c. The system shall (DD1766) provide mechanisms to ensure the integrity of all security and mission critical data that is sent to or received from any external interface.

3.6 FAA Academy Training Facilities

The Training Support System shall (DD1853) duplicate the function of a field system.

It shall (DD1854) have the capability to be isolated from other training systems in such a manner that training can be performed without interference with other equipment operations or training.

3.6.1 FAA Academy Hardware Training Equipment

The equipment configuration and quantities shall (DD1856) be provided to accommodate four (4) hardware laboratories for three students each.

3.6.2 FAA Academy Software Training Facilities

Software training computer terminals shall (DD1862) be provided on a one (1) terminal per student ratio.

4.0 Appendix - Acronyms and Abbreviations

A	Assistant
ACES	Adaptation Controlled Environment System
ANSI	American National Standard Institute
APD	Automated Problem Detection
APDIA	Automation Problem Detection Inhibited Area
APR	ATC Preferred Route
ARTCC	Air Route Traffic Control Center
AT	Air Traffic
ATC	Air Traffic Control
ATM	Air Traffic Management
CAS	Commercially Available Software
CDC	Computer Display Channel
CFAD	Composite Flight Data Processing
CHI	Computer Human Interface
CID	Computer ID
CONUS	Continental United States
COTS	Commercial Off-the-Shelf
CP	Conflict Probe
CPSD	Cursor Positioning/Selection Device
CRD	Computer Readout Device
CRLD	Computer Readout Logical Display
CRT	Cathode Ray Tube
D-Position	Data - Position
DART	Data Reduction and Analysis Tool
DR&A	Data Reduction and Analysis
DS	Display System
DSR	Display System Replacement
DSSC	DSR System Support Complex
DYSIM	Dynamic Simulation
EDARC	Enhanced Direct Access Radar Channel
EDI	Enhanced DSR Infrastructure
EMI	Electromagnetic Interference
ESSC	En Route System Support Complex
FAA	Federal Aviation Administration
FCC	Facility Configuration Console
FDB	Flight Data Block
FDIO	Flight Data Input Output
FPA	Fix Posting Area
FRU	Field Replacement Unit
FSP	Flight Strip Printer
GFE	Government Furnished Equipment
GRIB	Gridded Binary
HCS	Host Computer System

HID	Host Interface Device
ICAO	International Civil Aviation Organization
ICD	Interface Control Document
ID	Identification
IEEE	Institute of Electrical and Electronics Engineers
IFR	Instrument Flight Rules
IRD	Interface Requirements Document
KSD	Keyboard Selection Device
LAN	Local Area Network
LRU	Line Replaceable Unit
LS	Loudspeaker
M&C	Monitor and Control
MI	Modulation Index
MTBF	Mean Time Between Failure
MTF	Modulation Transfer Function
NADIN	National Airspace Data Interchange Network
NAS	National Airspace System
NEMA	National Electrical Manufactures Association
NEXRAD	Next Generation Radar
NFCC	National Flow Control Center
nm	Nautical mile
ORD	Operational Readiness Demonstration
PAR	Preferential Arrival Route
PDAR	Preferential Departure Arrival Route
PDR	Preferential Departure Route
PVD	Plan View Display
PVLD	Plan View Logical Display
QAK	Quick Action Key
R	Radar
RUC	Rapid Update Cycle
SAR	System Analysis Recording
SH	Sector Assignment Status
SSF	System Support Facilities
STAR	Standard Terminal Arrival Route
T&E	Test and Evaluation
TF	Training Sector-FPA Assignment
UDS	Universal Data Set
URET	User Request Evaluation Tool
VCE	VSCS Console Equipment
VEM	VSCS Electronics Module
VFR	Visual Flight Rules
VSCS	Voice Switching and Control System
WARP	Weather & Radar Processor
WJHTC	William J. Hughes Technical Center

5.0 Appendix - Definitions

[Note: Definitions for standard ATC terms can be found in FAA Order 7110.65. They are not repeated here.]

Action Indicator—An indicator, in a controller input message having multiple uses, which defines the use of a specific instance of the message. For example, in a message intended to change the status of something, an action indicator could specify "on" or "off."

Activate—vt.

a. Airspaces and restrictions: Used in connection with airspaces and restrictions that are not continuously active. To activate means to declare formally that the airspace or restriction is active. Cf. "Deactivate."

b. Flight Plans: Used in connection with Flight Plans that are filed while the subject aircraft are on the ground. The HCS activates a Flight Plan when it receives a confirmed surveillance track on the subject aircraft or a controller at the position controlling the aircraft enters a Departure Message.

Activation Schedule—A designated schedule for activating and deactivating an airspace or restriction.

Adaptation—The process of entering adaptation data into an ATC automation system to tailor that system to the requirements of an individual ATC facility.

Adaptation Controlled Environment System (ACES)—Part of the HCS software that supports creation of adaptation data.

Adaptation Data—Data entered into an ATC automation system to assign specific values to system parameters. This data includes:

a. Display setup information.

b. Function optimization values.

c. Facility-specific data that describes the operational environment of an ATC facility's area of control, excluding aircraft.

Affected System—a term used in CP interfacility processing to define a CP in another facility to which CP sends data for a flight.

Aircraft—In this document, the term "aircraft" is used to refer to a flight.

Aircraft Conflict—See "Aircraft-to-Aircraft Conflict."

Aircraft-to-Aircraft Conflict—A conflict involving exactly two aircraft.

Aircraft-to-Airspace Conflict—A conflict involving exactly one aircraft and one Planning Region Airspace (q.v.).

Aircraft Types—Type of aircraft (e.g., B727, B747, DC10).

Air Route Traffic Control Center (ARTCC)—An air traffic control facility whose primary function is to provide separation to aircraft en route between airports.

Airspace—This term has two different meanings in ATC parlance:

a. Broad: The atmosphere, or some large category of it. (e.g., "The National Airspace," "controlled airspace.")

b. Narrow: A volume, defined by a prism or a set of joined prisms described as a series of geographic locations on the Earth's surface and at most two altitudes above it, within which special restrictions on flight apply.

Airspace Conflict—See "Aircraft-to-Airspace Conflict."

Airways—A formally designated controlled area, the centerline of which is defined by radio navigational aids.

Alert—A notification to a position that there is an aircraft-to-aircraft or aircraft-to-airspace problem, as detected by APD.

Amendment—An ATC approved change to a flight plan.

APD Boundary—a boundary that extends a parameter distance beyond a facility's airspace in which CP interfacility processing makes trajectory modeling and conflict detection as accurate as it is within the facility.

APD Zone—the airspace beyond the facility's airspace and within the APD boundary.

Assignable Altitude—An altitude which ATC can clear an aircraft to fly, under the procedural requirements of FAA Handbook 7110.65. Whether an altitude is "assignable" depends on the altitude itself, the characteristics of the airspace in which flight is planned, the capabilities of the aircraft, and other constraints.

Assignable Flight Level—See "Assignable Altitude."

Automated Problem Detection (APD)—An Automation Processing capability that checks Trajectories for problems.

Automated Problem Detection Inhibited Area (APDIA)—An airspace corresponding to TRACON airspace in which APD is inhibited. Only the flight segments that are in the applicable APDIA have problem detection inhibited.

Automated Replan—A function which creates and evaluates new Trial Plans for designated aircraft. The input Trial Plan will define some maneuver that the controller wants the system to recheck periodically for problems.

Beacon Code—A code assigned to and identifying an aircraft based on aircraft equipped with a beacon transponder.

Calculated Time of Arrival (CTA)—For each converted fix of a flight plan route the time of arrival computed from information on the converted route segments, the planned speed, aircraft characteristic data, the vertical profile of the aircraft, and weather data.

Clearance—An authorization from ATC for an IFR aircraft to follow a specified route, vertical profile, and/or speed schedule. A clearance always applies to a particular set of traffic conditions within controlled airspace, and is designed to maintain separation minima between the cleared aircraft and other known aircraft.

Clearance Delivery—The process of transmitting a clearance from a controller at an ATC position to a pilot in an aircraft.

Code—vt. A generic term for marking information on a display (e.g., by changing intensity).

Coded Routes—A route that is predefined and published in the Airmen's Information Manual. For example, training routes which have predefined entry and exit points and altitude limits

Computer Human Interface (CHI)—Those aspects of the system design, implemented via software, that permit and facilitate the transfer of information between the user and the automation.

Conflict—An event detected by APD. One of the following:

a. Predicted violation of separation criteria between aircraft Trajectories.
b. Predicted violation of separation criteria between an aircraft trajectory and a Planning Region Airspace.

Notice that "conflict" can (and is) used interchangeably with "problem" for these events.

Conformance—The condition established when an aircraft's actual position is within the conformance region constructed around that aircraft at its position, according to the trajectory associated with the aircraft's Current Plan.

Conformance Bounds—Parameters used (1) by APD in determining when to declare conflicts, and (2) in Conformance Monitoring.

Conformance Monitoring—A capability that detects when the actual position of an aircraft is not within the conformance region associated with the current time.

Conformance Region—A volume, bounded laterally, vertically, and longitudinally, within which an aircraft must be at a given time in order to be in conformance with the Current Plan trajectory for that aircraft. At a given time, the conformance region is determined by the simultaneous application of the lateral, vertical, and longitudinal conformance bounds for the aircraft at the position defined by time and aircraft's trajectory.

Continual—Performed at some stated interval, without separate user initiation of each iteration. Notice that there may be periods between iterations when the process being described as continual is not being performed at all. Contrast with "continuous," which implies constantly doing something.

Controlled Tracks—Indicates those tracks whose associated aircraft are provided separation serves by air traffic control.

Controlling Facility—The ARTCC that controls the track for a given flight.

Converted Route—A route that has been processed by the Route Segment Conversion process. (See Route Segment Conversion).

Coordination—An attempt to negotiate agreement among all the positions having present and future responsibility for the consequences of some proposed change in an aircraft's clearance.

Coordination Fix—A fix at which facilities coordinate flight progress data; for example, a fix at which an aircraft is expected to cross the boundary between the areas controlled by two facilities.

Coordination Time—The time a flight is planned to cross a coordination fix.

Countdown Clock—An indicator, displayed to controllers, which shows the time remaining before some event is expected to happen.

Current Plan—The Plan for a flight that ATC has specified as the Plan the aircraft currently is expected to fly. Current Plan includes flight plan data, trajectory, and conformance bounds.

Current time—the current value of the time in CP.

Current Position—This term has two different meanings:

a. In establishing ATC responsibility: The position (first meaning) that most recently was the receiving position in a Transfer of Control concerning an aircraft, as recorded in the HCS.

b. In establishing location: The current placement of some object (e.g., an aircraft) on the earth's surface, or of some point on the earth's surface perpendicularly below the object.

c. Note: In most cases, context makes clear which of these meanings is intended. Where a specific distinction is needed, "current ATC position" is used to force meaning a. and "current geographic position," to force meaning b.

Deactivate—A term used herein in connection with airspaces (second meaning herein) and restrictions that are not continuously active. "Deactivate" means to declare formally that such an airspace or restriction is inactive. C "Activate."

Designated Position—The position at which a particular aircraft-to-aircraft, or aircraft-to-airspace alert will be displayed.

Dimension—One of three components into which flight is decomposed. The three are:

a. Lateral Dimension. The horizontal component of flight; that is, the component of flight that can be modeled as taking place at a constant altitude. (Note: The lateral component of flight often is thought of as taking place on a plane surface. That is only a convenient approximation; actually, the surface is curvilinear.)

b. Vertical Dimension. The component of flight that can be modeled as taking place along a line kept constantly perpendicular to the earth's surface as the aircraft flies above it.

c. Longitudinal Dimension. The component of flight that can be modeled as velocity of travel along the aircraft's planned or actual path.

Distance Measuring Equipment (DME)—Equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid.

Downstream—Adj. A sector (or, in some usage, a facility airspace) which an aircraft will enter after it leaves the sector (or facility airspace) in which it currently is flying, according to the trajectory associated with some Plan for that aircraft.

Downstream Fix—A fix which is further along the route of flight of the aircraft from the current position.

Dynamic Simulation (DYSIM)—Operational capability of the Host Computer System (HCS) to process and display data for simulated ATC problems for training controllers in ARTCCs.

Entry—A unit of information on a display, meaningful as a single entity and posted to a display as a single entity.

Facility—A short form of "ATC facility." An example would be an "Air Route Traffic Control Center" (ARTCC). A facility is operated by the FAA and contains people, workspace, automation, and other support needed for air traffic control.

Facility Airspace—Airspace within which ATC is provide by the staff of a facility.

Facility Area—The system supports ATC within the volume of airspace assigned to an ARTCC. The projection of this volume on the earth's surface is the facility area for that ARTCC.

Field—A unit of a message or display entry.

Flight Plan—The original filed Flight Plan for a flight, with all later Flight Plan changes incorporated.

Fix—A geographical position determined by visual reference to the surface, by reference to one or more radio navaids, by celestial plotting, or by another navigational device.

Fix Posting Area (FPA)—In the Host Computer System, FPAs are volumes of airspace used to define where "flight strips" are posted, and relative to what fix the posting applies. FPAs are the fundamental units from which sectors, approach control areas, and other volumes used in the assignment of ATC responsibility are defined within the facility. See NAS-MD-312 for additional information.

Flight Categories—The system classifies flights into categories based on the track data being received.

Flight Data Base—A repository of information about all flights.

Flight Plan—The original filed Flight Plan for a flight, with all later Flight Plan changes incorporated.

Ground Speed—The speed of an aircraft relative to the ground.

Handoff—An action taken to transfer ATC control of an aircraft from one position (the initiating position) to another (the receiving position) when the aircraft will enter the receiving position's airspace.

Hold—A maneuver type which keeps an aircraft within a specified airspace for a specified period of time.

Host Computer System (HCS)—Primary automation system providing support to ATC in an ARTCC. The HCS operational capabilities include radar data processing, flight data processing, and DYSIM.

Initial Conflict Probe—the initial nationally deployed version of the conflict probe function.

IFR Aircraft—An aircraft conducting a flight according to Instrument Flight Rules.

Inhibit—To prevent the operation of a function. When a function is "inhibited," it is not performed.

Initial Point of Violation—For an aircraft-to-aircraft conflict or aircraft-to-airspace conflict, the initial location where separation criteria are violated.

Instrument Flight Rules (IFR)

a. Rules governing the procedures for conducting "instrument" flight.

b. Weather conditions not permitting flight under Visual Flight Rules.

c. A type of Flight Plan.

Interfacility—Between facilities or systems within facilities for example, between ARTCC and ARTCC or between CP in different facilities.

Interim Altitude—An altitude to which the controller clears an aircraft, with the expectation that the aircraft "soon" will be cleared to some higher or lower altitude.

Lateral Maneuver—A maneuver that can be stated solely as a horizontal deviation (deviation in the x-y plane) from the clearance previously given the pilot of the aircraft.

Logical Display—A "conceptual" display containing prescribed types of information. When a given Logical Display is presented at an ATC position, all of the information in the display is available to controllers at that position, but not all that information necessarily will appear, concurrently, on the display surface; scrolling or other actions may be necessary to view all the information.

Longitudinal Maneuver—A maneuver that can be stated solely as a longitudinal deviation (deviation in speed) from the clearance previously given the pilot of the aircraft.

Lookahead—A parameter representing an amount of time. The lookahead time is added to the current time or some future time, in order to define the upper bound of a time interval (the lower bound being either the current time or the future time selected as the starting time). For example, the system must ensure that users receive notification of aircraft-to-aircraft conflicts at least a parameter time (i.e., a lookahead time) before separation is predicted to be lost.

Maneuver—This term has two entirely different meanings, usually distinguishable by context.

a. Any pilot action that causes the pilot's aircraft to fly differently than it is flying now. For example, turn, level off, slow down.

b. Any change in the planned flight of an aircraft.

Maneuver End Point (MEP)—The point at which the system considers a maneuver to be completed. Determination of the MEP depends on the dimension of the maneuver.

Maneuver Start Point (MSP)—The first point on a Plan trajectory at which a maneuver, if implemented, would cause the aircraft to digress from that trajectory in any dimension (lateral, vertical, longitudinal).

NAS Stage A—The suite of software running in the Host Computer System. This software was largely rehosted from the previous generation of automation support to en route ATC, the 9020-series of computers.

National Airspace System (NAS)—The US flight environment. The NAS includes:

a. Air navigation facilities, equipment, and services
b. Airports and landing areas
c. Aeronautical charts, information, and information services
d. Rules, regulations, and procedures
e. Manpower
f. Materiel

Neighboring Facility—a term used in CP interfacility processing to define the other CP facilities whose airspace overlaps a given facility's APD boundary.

Nonconformance—The state of (an aircraft's) being out of conformance. The condition for which Conformance Monitoring checks.

Out of conformance—A term applied to an aircraft whose track is not in conformance, laterally, vertically, and/or longitudinally, with its Current Plan trajectory.

Owning CP—a term used in CP interfacility processing to define the CP responsible for maintaining data for a flight in CP in other facilities.

Parameter

a. n. A variable affecting automation processing.
b. adj. "Parametrically-defined," where "parametrically" conveys one of the meanings of "parameter" in a.1 and a.2 immediately above. For example. "After a parameter time, the display will be removed." means "After a predetermined amount of time (which, in the operational environment, will be specified system-wide or set at the facility level), the display will be removed."

Physical Display—A physical surface of fixed dimensions on which logical displays, or parts of logical displays, can be made to appear for viewing.

Plan—Information about a flight, and pilot and controller intentions regarding that flight. Such Plans include Flight Plans, Current Plans, and Trial Plans. "Plan" also is used to refer generically to all of the preceding.

Planned Action—An action (e.g., change in route, altitude, speed, or hold) planned for an aircraft and reflected in the trajectory of that aircraft for purposes of problem detection. The aggregate of Planned Actions for a flight represent both the pilot's intentions and the ATC's intentions for that flight.

Planned Holding Area (PHA)—The rectangular area used by the system to represent airspace to be protected when the user requests to apply a PHA to a flight. The PHA is used by the trajectory modeler to determine conflicts.

Planning Region—The airspace volume controlled by a facility, plus a buffer volume around it to allow space for accurate trajectory modeling and for problem detection.

Planning Region Airspace—An airspace whose location and activation schedule are known, at a given facility, only if the airspace is located in that facility's planning region.

Plan Processing—A capability that accepts, processes, stores, maintains, and deletes Plans.

Point of Violation—See "Initial Point of Violation."

Position

a. A display or workstation providing automation support to controllers performing ATC.

b. The current geographic location of some object (e.g., an aircraft) on the earth's surface, or of some point on the earth's surface perpendicularly below the object.

Note: In most cases, context makes clear which of these meanings is intended. Where a specific distinction is needed, documentation uses "ATC position" to force meaning a. and "geographic position" to force meaning b.

Post—vt. To add information to a display.

Preferential Arrival Route (PAR)—A specific arrival route from an appropriate en route point to an airport or terminal area providing rigidly controlled flight paths.

Preferential Departure and Arrival Route (PDAR)—A route between two airports providing a rigidly controlled flight path.

Preferential Departure Route (PDR)—A specific departure route from an airport or terminal area to one or more en route points providing rigidly controlled flight paths.

Problem—One of the following:

a. Predicted violation of separation criteria between aircraft Trajectories.

b. Predicted violation of separation criteria between an aircraft trajectory and a Planning Region Airspace.

Radar

a. n. An electronic means of tracking aircraft in flight.

b. adj. Implying a requirement that reliable ATC radar coverage be regularly available. For example, "radar separation" is separation of aircraft based on position information from radar returns, possibly augmented by other sources. A "radar area" is an airspace defined, in facility adaptation, as normally having reliable ATC radar coverage.

Radar Vector—See "Vector," first meaning.

Receiving Facility—The ARTCC that will accept handoff of a given flight and assume control of the track for that flight.

Receiving CP—The CP executing in a neighboring receiving facility that will assume ownership of a given flight once flight handoff is complete.

Reconformance—The process of bringing an aircraft's Current Plan trajectory into conformance with its track, when the former is out of conformance. Reconformance involves adjustment of the trajectory.

Re-enable—To negate any previous action to inhibit a function (see "inhibit," second meaning), and simultaneously direct the execution of that function.

Remote CP—the CP in another facility.

Remove—To take away information on a display.

Restore—A controller action to display information on a logical display; the controller can remove the information again, by an action to suppress that information.

Resynchronization—Longitudinal Reconformance. (See "Reconformance," paragraph c.)

Route—A sequence of fixes and airways, where fixes may be in terms of navaids, named intersections, fix radial distances, or latitude-longitude pairs.

Route Segment Conversion—Process of converting the route of flight of an aircraft into a series of segments that make up the route across the surface of the Earth.

Sector—A unit of airspace within a facility area. An airspace (second meaning) defined to represent exactly the volume within which control of air traffic is the responsibility of the controller(s) at a single operational position (first meaning).

Segment—A portion of the desired route of flight stated in a filed Flight Plan. A route segment is a straight line connecting two objects (fixes, intersections, airspace entry points, etc.) whose names are adjacent in the Flight Plan's "Route" field.

Separation—In ATC, the spacing of aircraft to achieve their safe and orderly movement, both in flight and while landing and taking off.

Separation Criteria—Separation criteria are values used by the system in determining whether conflicts exist.

Severity Coding—coding of an alert to indicate to the controller the severity of the alert. In CP, aircraft-to-aircraft alerts will have multiple levels of severity based on whether the procedural separation rules are predicted to be violated.

Standard Instrument Departure (SID)—A preplanned instrument flight rule (IFR) air traffic control departure procedure printed for pilot use in graphic and/or textual form. SIDs provide transition from the terminal to the appropriate en route structure.

Standard Terminal Arrival (STAR)—A preplanned instrument flight rule (IFR) air traffic control arrival procedure published for pilot use in graphic and/or textual form. STARs provide transition from the en route structure to an outer fix or an instrument approach fix arrival waypoint in the terminal area.

Suppress—A controller action to remove information from a logical display; the controller can return the information to the logical display by an action to restore that information.

Tactical Airspace—an airspace within an APDIA in which APD is inhibited for any aircraft within the airspace.

Top of Descent (TOD)—The location (expressed in geographic position or in time along trajectory) at which an aircraft begins (or is to begin) its descent from cruising altitude to destination.

Track—The dynamic data, including position and velocity, stored for a flight and maintained by the tracking function in the Host Computer System

Trajectory—A representation of the path an aircraft is expected to take, based on a Plan. A ground-referenced representation, in x, y, z, and t, of the expected path, based on flight intent information recorded in the Plan.

Trajectory Modeling—the process of calculating a trajectory.

Transfer of Control—The part of handoff that is concerned with designating a new current position for an aircraft.

Transition—v. or n. A change in altitude, speed, or route.

Trial Plan—Any Plan created by Trial Planning upon request of a user or action by the automation.

Trial Planning—A term which refers, collectively, to all the means of Trial Plan creation.

True Airspeed—The rate of motion of an aircraft relative to the air mass surrounding it.

Type of time field—a designator in the coordination time field contained in a flight plan indicating what the time represents. For example, "P" for Proposed time of departure, "E" for estimated time, "D" for actual time of departure.

User Request Evaluation Tool (URET)—A concept prototype developed by Mitre and installed at one or more sectors in an ARTCC for evaluating a conflict probe capability.

Upstream—Adj.

a. The sector (or, in some usage, the facility area) from which an aircraft will enter some other sector (or facility area), according to the trajectory associated with some Plan for that aircraft.
b. The position (or, in some usage, the facility) which will control an aircraft immediately before it is controlled by some other position (or facility in which the current position is located), if its flight continues according to the trajectory associated with some Plan for that aircraft.

Vector—A heading issued to the pilot of an aircraft, by a controller at the position controlling that aircraft, to provide navigational guidance supported by ATC radar.

Vertical Maneuver—A maneuver for an aircraft that can be stated solely in terms of vertical deviations (deviations in the z-dimension) from the clearance previously given the pilot of that aircraft.

Vertical Profile—A description of the vertical component of an aircraft's flight. A vertical profile consists of an ordered set of pairs (A,t) in which A is an altitude or flight level and t is the time by which that aircraft is to have attained that altitude or flight level.

VFR Aircraft—An aircraft conducting flight in accordance with Visual Flight Rules.

Violation—A loss of required separation between an aircraft and either another aircraft or an airspace.

Visual Flight Rules (VFR)

a. Rules that govern the procedures for conducting flight under visual (noninstrument) conditions.
b. In the US: Weather conditions that are equal to or better than minimum requirements for noninstrument flying.
c. A type of Flight Plan.

Warning Time—The predicted time to violation of separation criteria, measured at the time of the first appearance of an alert at the position whose controllers must take action.

X Windows—A network based windowing system, developed by MIT's Project Athena, that has been implemented on various operating system platforms, (i.e., UNIX, VMS, DOS, MAC OS, etc.). X windows provides a foundation for developing graphical user interfaces.